

JOINT THEATER MISSILE DEFENSE IN TAIWAN: PROTECTING
UNITED STATES INTERESTS AND FRIENDS

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ABSTRACT

JOINT THEATER MISSILE DEFENSE IN TAIWAN: PROTECTING UNITED STATES INTERESTS AND FRIENDS, by Major Joseph P. Carroll, 87 pages.

The debate of whether the US should deploy Joint Theater Missile Defense (JTMD) to defend deployed troops and interests in East Asia has come to a close. The *National Security Strategy of the United States of America* outlines how this type of defensive deterrent is necessary to protect national interests and facilitate alliance responsibilities. With respect to Taiwan, the US has a codified requirement under the *Taiwan Relations Act* of 1979 to provide defense articles, as well as a national interest in defending the island's independence. These responsibilities are complicated as China continues to deploy a robust arsenal of ballistic missiles targeted on Taiwan. Thus, the primary research question is: Should the US provide JTMD support to Taiwan? Three sets of studies by prominent think tanks are used to conduct a thorough meta-analysis of these issues to develop conclusions and implications for US policy. This work concludes that the US should come to the aid of Taiwan if necessary, but should not seek to include Taiwan in an interoperable JTMD architecture. Additionally, the US should reevaluate JTMD arms sales to Taiwan to include the sale of attack operations capability, as necessary, to counter the Chinese threat.

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ACRONYMS

ABM	Antiballistic Missile Treaty (US-USSR 1972)
ABL	Airborne Laser
AWACS	Airborne Warning and Control System (E-3A aircraft)
BMC4I	Battle Management, Command, Control, Communication, Computers, and Intelligence
C2	Command and Control
C4ISR	Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance
CEP	Circular Error Probable
GBMD	Ground-Based Midcourse Defense
JTMD	Joint Theater Missile Defense
ICBM	Intercontinental Ballistic Missile
IOC	Initial Operational Capability
LACM	Land Attack Cruise Missile
LRBM	Long-Range Ballistic Missile
MRBM	Medium-Range Ballistic Missile
NMD	National Missile Defense
NTW	Navy Theater Wide
PAC(x)	Patriot Advanced Capability (Versions 1, 2, and 3)
PRC	Peoples Republic of China
ROC	Republic of China (Taiwan)
SLOC	Sea Line of Communication
SOF	Special Operations Forces
SRBM	Short-Range Ballistic Missile

TBM	Tactical Ballistic Missile
THAADs	Terminal High-Altitude Area Defense System--known as Theater High-Altitude Area Defense System prior to February 2004
TMD	Theater Missile Defense. Synonymous with Joint Theater Missile Defense (JTMD)
USAWC	US Army War College
WTO	World Trade Organization
WMD	Weapon of Mass Destruction

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CHAPTER 1

THE DYNAMIC OF MISSILE DEFENSE IN THE STRAIT

Context of Thesis Question: Missile Defenses in Taiwan

The 2002 *National Security Strategy of the United States of America* (2002 NSS) clearly asserts that the United States (US) has significant national interests in the Northeast Asian region and that the US will pursue missile defense systems to protect citizens and soldiers, both at home and abroad, from the threat of missile attack (Bush 2002, 6). In the East Asia region this partly amounts to the deployment of a joint theater missile defense (JTMD) system to protect US forces, allies and friends, and other key facilities and locations from the threat of short- and medium-range tactical ballistic missiles (TBMs). However, both China and North Korea have stated that they view the employment of JTMD in East Asia as a threat and will respond by increasing their production and pursuit of advanced TBM capabilities, sparking a potential regional security dilemma (Center for Nonproliferation Studies 2003, 4-6). Furthermore, the deployment of a US JTMD shield in support of Taiwan would unquestionably evoke a Chinese reaction that exceeds mere proliferation of ballistic missiles. As the People's Republic of China (PRC) still views Taiwan as part of "China," the US must measure the cost and benefit of all policies regarding Taiwan. The question that this thesis seeks to answer is, Should the US deploy a joint theater missile defense system in support of Taiwan?

The debate over whether the US should deploy JTMD in the East Asian Theater has spanned the past two decades, as missile defense technology has evolved. The 2002 NSS, however, uses strong language to indicate that JTMD deployments will be

underway shortly. Although the strategy addresses the positive continuation of economic relations with China, it also clearly states that the US-China disagreement on the defense of Taiwan, under the *Taiwan Relations Act*, remains a significant issue (Bush 2002, 27-28). Therefore, the potential for a missile defense deployment in support of Taiwan remains a problematic issue that warrants further research.

The *Taiwan Relations Act*: Cornerstone of US-Taiwan Policy

Context of the *Taiwan Relations Act*

In addition to the primary focus on Soviet Union relations during the bipolar years of the Cold War, the US also enacted the 1979 *Taiwan Relations Act*, which heavily impacts current US relations with both Taiwan and China. This act codifies the diplomatic position that the US has terminated governmental relations between the US and the governing authorities on Taiwan--recognized by the US as the Republic of China prior to 1 January 1979 (*Taiwan Relations Act* 1979, Sec. 3301). However, despite the lack of formal recognition of Taiwan, the act clearly states that the US decision to establish relations with the People's Republic of China is predicated on the expectation that Taiwan's future will be determined by peaceful means. Additionally, military action against Taiwan, by the People's Republic of China, will be considered a "grave threat to peace and security in the Western Pacific" (*Taiwan Relations Act* 1979, Sec. 3301). To prevent this potential conflict and maintain a status quo between the offensive capability of China and the defensive capability of Taiwan, the act authorizes the US to provide Taiwan with defensive equipment, services, and support, as necessary, to enable its self-defense capabilities.

Providing for the Defense of Taiwan

The *Taiwan Relations Act* stipulates that the decision to provide Taiwan with defensive articles and support rests solely with the President and Congress based on their assessment of the defense needs of Taiwan (*Taiwan Relations Act* 1979, Sec. 3302). Considering China's consistent proliferation of ballistic missiles over the past decade and its persistent threats to Taiwan, there is little doubt that Taiwan is in significant need of a means of ballistic missile defense (Fisher 2002, 1-2). While the *Taiwan Relations Act* provides a legal precedent and basis for the US to provide this assistance, the expected reaction of a nuclear-armed China remains the sole significant impediment. Should the US provide JTMD support to Taiwan--in terms of capability, technology sharing, training, and equipment sales? Should this JTMD system be a combined interoperable effort with Taiwanese Military Forces or a US only missile shield? How will China react to a US only JTMD shield over Taiwan? How will China react to a US-Taiwan interoperable JTMD system? How will China react to an increase in Taiwan's JTMD capabilities? This thesis will seek a feasible, acceptable and suitable policy recommendation based on the contemporary operational environment, existing agreements and frameworks, and the current political climate.

The Ballistic Missile Versus the Ballistic Missile Defense Debate

The Mutually Assured Destruction Paradigm

The debates over the deployment of missile defense shields have been ongoing since the Cold War. At the height of US-Soviet Union tensions, it was the lack of missile defense systems that actually provided the relative global stability that facilitated the use of the diplomatic and economic elements of US national power to slowly deteriorate the

“iron curtain.” Since neither the Soviet Union nor the US possessed the ability to shoot down the other’s nuclear missiles, each side was assured that any nuclear engagements would result in the mutually assured destruction of both countries (Mazarr 1989, 3). This counterintuitive concept ensured stability and security.

Security Dilemma Overview

Missile defense systems, deployed by either side, would cut into this relative stability by potentially rendering the nuclear arsenal of one side ineffective, thereby creating an imbalance of power. The only way to counter this imbalance would be to increase the size of one’s nuclear arsenal to provide overmatch of the missile defense system and once again reach a point where both sides could reasonably expect to completely destroy each other in a nuclear engagement; thus, the missiles shields were viewed as destabilizing (Mazarr 1989, 3-6). To prevent this type of security dilemma, both the US and Soviet Union signed the Antiballistic Missile (ABM) Treaty in May 1972, which provided that neither side would deploy missile shields capable of defeating the other’s strategic nuclear ballistic missiles (Department of State 1972, Article I). This treaty remained intact throughout the Cold War and served as a pillar of bipolar security and stability.

Distinguishing Between National and Theater Missile Defense Capabilities

Capabilities in Operation Desert Storm

Although the ABM Treaty specifically prohibited the development of national missile defense (NMD), it did not place restrictions on the development of shorter-range missile defense systems that were not capable of defeating a nation’s strategic ballistic missile arsenal. Thus, the US began the open development of such systems to protect

deployed troops and other high-value assets from the threat of TBM attack. The initial fruits of these efforts were seen during Operation Desert Storm in 1991, where US Patriot (PAC 1 and 2) Missile systems were deployed, with limited success, to defeat Iraqi scuds fired at troop concentrations, command and control assets, and Israel--a US friend and ally (Stein and Postol 1992, 238-240).

Pursuit of Increased JTMD Capabilities

Although the development of the Patriot missile system, and other JTMD technologies, continued in earnest after Operation Desert Storm, much of the emphasis on exploiting missile defense technology was subdued throughout the 1990s as the US faced a number of small scale contingencies and stability operations. However, the US administration rekindled these efforts in 2001 and began building the case for both JTMD and NMD under the premise that the ABM Treaty was a Cold War relic that was no longer applicable in the current environment (Glasser 2001, 28). While this clearly set the stage for the US withdrawal from the treaty, the 11 September 2001 attacks surely accelerated the process--prompting President Bush to announce the US' withdrawal from the ABM Treaty on 14 December 2001.

JTMD Capabilities in Operation Iraqi Freedom

Technological advances in missile defense capabilities have turned the prospect of JTMD deployment into a realistic option. The most recent significant example of evolving US JTMD technology was highlighted during Operation Iraqi Freedom in early 2003. US Patriot (PAC 2 and 3) missiles were once again deployed to counter Iraqi scuds during the US-led coalition's advance on Baghdad. During this deployment, the improved Patriot missiles performed with much more precision and success than was

experienced in Operation Desert Storm. Initial reports indicate that nine of nine Iraqi missiles that would have impacted in the location of US troops and equipment were defeated by Patriot missiles (Ruppe 2003, 1-2). Although the deployment of Patriot missile systems, in and of themselves, does not constitute a true theater missile defense system, Patriot's performance in Operation Iraqi Freedom demonstrates the potential of the technology. While the US has already proven its resolve to employ JTMD in support of its deployed soldiers, this thesis will analyze the issue of deploying JTMD in support of allies, friends, and national interests.

Operational Definitions of Key Terms

National Interests. National interests define the broad purposes of US foreign policy and are manifest in the foreign policy and national security goals of the US. In its simplest terms, "the fundamental national interest of the US is the defense and well being of its citizens, its territory, and the US constitutional system"(Nuechterlein 2001, 12-13). For the purpose of this thesis, the following subcategories of "national interests" will be used to analyze potential courses of action vis-à-vis Taiwan and China:

1. Survival interest. A survival interest is at stake when there is an imminent, credible threat of massive destruction to the homeland if an enemy state's demands are not countered quickly.
2. Vital interest. A vital interest differs from survival interest in the amount of time the country has to decide how it will respond to an external threat. It may involve economic, world order, and ideological issues, in addition to homeland defense, and may ultimately be as dangerous to the country as a military attack. These threats can be potential or probable but not imminent.
3. Major interest. A major interest is one that a country considers to be important but not crucial to its well being. These involve issues and trends, whether economic, political, or ideological, that can be negotiated with an adversary. Policy makers usually come to the conclusion that negotiation and compromise, rather than confrontation, are desirable--even though the result may be painful.

4. Peripheral Interest. A peripheral interest is one that does not seriously affect the well being of the US as a whole--even though it may be detrimental to the private interests of Americans conducting business abroad. These interests are of a lower order of political, economic, and ideological magnitude. (Nuechterlein 2001, 21)

Theater Missile (TM). The term TM applies to ballistic missiles, cruise missiles, and air-to-surface missiles whose targets are within a given theater of operations. Short-range, non-nuclear, direct fire missiles, bombs, and rockets, such as Maverick or wire-guided missiles, are not considered TMs for the purpose of this thesis (Department of Defense 1996, I-2). Significant numbers of Chinese ballistic and cruise missiles, deployed in southern China opposite the Taiwan Strait, comprise the primary threat to Taiwan.

Joint Theater Missile Defense (JTMD). JTMD consists of the strategies and tactics employed to defend a geographical area against attack from short-range or intermediate-range ballistic missiles, as well as passive measures, the command, control, communication, computer, and intelligence (C4I) systems, and the tactical ballistic missile (TBM) defense system forces that, in total, provide defense against ballistic missile attacks within a theater of operations (Department of Defense 1996, vii-ix). This definition is largely derived from the US perspective that JTMD will operate in an overseas deployment area to defend against short- and medium-range missiles. From a Taiwanese perspective, the same JTMD system serves almost as a NMD system. The key distinguishing feature in this context, however, is that JTMD is not designed to defeat China's strategic nuclear arsenal, just the conventional ballistic and cruise missiles that threaten Taiwan.

JTMD Architecture. Due to the complexity and diversity of ballistic missile threats, no single weapon system is currently capable of performing the entire JTMD

mission. JTMD missions are therefore divided into overlapping tiers that combine to form a theoretically leak-proof defense that provides for multiple engagement opportunities. Upper tier exo-atmospheric systems engage threat missiles outside of the earth's atmosphere during the midcourse phase of flight. Lower tier endo-atmospheric, systems engage threat missiles within the earth's atmosphere, normally during the descent phase of flight. The ideal system would intercept during the boost-phase of flight to destroy the threat missile before it has a chance to leave the earth's atmosphere. The common element of all systems, however, is that they seek to destroy the threat missile at the maximum possible range to decrease damage from post-intercept debris and decrease the possibility of residual damage from a weapon of mass destruction (WMD) warhead.

Weapons of Mass Destruction (WMD). WMD can be considered as any weapon or device that is intended or has the capability to cause death or serious bodily injury to a significant number of people through the release, dissemination, or impact of: toxic or poisonous chemicals or their precursors, a disease organism, or radiation or radioactivity; or a large conventional explosive that produces catastrophic loss of life or property (*Crimes and Criminal Procedures* 2002, Section 2332a). Considering the second half of this WMD definition, Taiwan has significant concerns with the large numbers of Chinese ballistic missiles deployed against it on the opposite side of the Taiwan Strait. Given the short flight times and proximity to Taiwanese population centers, these TBMs could easily become WMD, despite being armed with conventional warheads.

Limitation and Delimitations of JTMD Deployment in Support of Taiwan

Geographical Limitation. In order to adequately address the strategic and operational issues involved with the deployment of JTMD in support of Taiwan, it is

necessary to isolate the focus and scope of this thesis. Therefore, a number of deliberate limitations and delimitations have been applied to the topic and thesis question. First, the topic is limited geographically. This thesis addresses US JTMD political and strategic implications as they relate to Taiwan. Other Northeast Asian actors are addressed only as they impact the primary thesis question.

Scope and Function of JTMD. Second, the research and scope of this thesis are limited to JTMD as defined in this chapter. As the US exploits NMD technology and NATO remains open to the possibility of a European missile shield, it is important to delineate the fundamental purpose and capability of each. This thesis does not address considerations for the employment of national or intercontinental ballistic missile (ICBM) defense systems that fundamentally protect states from strategic nuclear and long-range conventional ballistic missiles. This thesis focuses on the deployment impacts of JTMD, which is much smaller in scale and is designed to defeat short- and medium-range TBMs. Although a US JTMD system essentially acts as a NMD system for Taiwan, as its range can provide TBM coverage of the entire island, its mission and intent would be to defend against TBM and cruise missile threats and not the Chinese strategic nuclear capability.

JTMD Operational Elements. Additionally, this thesis is limited in scope of the JTMD operational elements considered. By US doctrine, JTMD operations include attack operations to destroy, disrupt, or neutralize TBM launch platforms, command and control, and other supporting components (Department of Defense 1996, I-4). While these types of operations are essential to wartime JTMD operations, they are offensive in nature and are generally not considered for use by US forces in support of Taiwan short

of a major combat operation with China. However, these types of capabilities will be addressed as they relate to Taiwan's capability and desire to provide for its own defense. From a US perspective, this thesis considers the JTMD elements of passive defense, active defense, and the C4I systems that enable JTMD operations but does not include attack operations. This thesis will consider attack operations in terms of JTMD sales to Taiwan and employment in the event of war.

Assumptions

Regional Security Arrangements Remain Status Quo. The premise of this thesis assumes that the *Taiwan Relations Act* of 1979, the US-Japan Security Alliance, and the US-South Korea Alliance will remain intact. The questions of whether the US should assist Taiwan with a JTMD shield and of how this should be done hinge extensively on the existing security arrangements in the area. Although a fragile stability currently exists in the East Asian region, any changes or fractures in the existing security framework will impact the relative perceived security of all states in the region and could invalidate security policy recommendations. This thesis also assumes that the decision to deploy JTMD in support of Taiwan will be a political decision that is not fiscally constrained or cost prohibitive to either the US or Taiwan.

Availability and Suitability of JTMD Systems. The prospect that any US JTMD deployment will be an inherently joint endeavor, meaning it would involve multiple US military services, is a fact that is supported by US doctrine and the inability of any single service to fully conduct a JTMD mission (Department of Defense 1996, vii).

Additionally, the fact that Taiwan has already purchased limited quantities of Patriot (PAC 2+) missiles makes it clear that, at least in the short term, these assets would form

the lower tier of any combined JTMD architecture (Shambaugh 2002, 323). Since the cancellation of the Navy Area Wide (NAW) program in December 1991, the US Navy's Aegis-based Navy Theater Wide (NTW) system, firing the standard missile 3 (SM-3), and the Army's Terminal High Altitude Area Defense System (THAADs) represent the US military's most advanced and deployable upper-tier JTMD systems (Center for Nonproliferation Studies 2003, 109-110). Of these two systems, NTW is far more suitable for defending an island nation and is therefore assumed to be the upper-tier system of choice for any Taiwan scenario.

Summary

The background, context, and framework presented so far provide the point of departure and focus for the research and analysis of this thesis. Given the complexity of the security framework in the region and the dynamics of regional actors, it is both useful and necessary to limit the scope of the thesis question. Using this focus, the next chapter will review the bodies of literature that are pertinent to the question at hand and extract the recommendations and conclusions of three prominent think tanks that will serve as the basis for answering the question of a US JTMD deployment in support of Taiwan.

CHAPTER 2

LITERATURE REVIEW

The first category of literature that the author incorporates into the analysis is the body of government documents relevant to JTMD. The 2002 NSS, documents from the Office of the Secretary of Defense, and publications from the Joint Chiefs of Staff provide the US senior civilian leadership and military leadership perspective on how the US views national interests, existing threats, and how the military needs to posture to counter those threats. The second general category of literature considered is the body of theoretical concepts that affect strategic relations between states. Specifically, the author reviews how the security dilemma paradigm, national interests, and missile proliferation may affect the employment of missile shields by the US and Taiwan, and the counteractions of China and other regionally affected states. Third, the author outlines the series of reports and studies that form the basis for the meta-analysis. These documents are a collective representative cross-section of government, military, and academic expert opinions on the Taiwan issue and form the basis for validating the findings of this thesis. The author also addresses the current periodicals and reports that track the ongoing dynamics between Asian states, specifically China and Taiwan.

Government Documents

National Security Strategy of the United States of America

With an unprecedented boldness, the 2002 NSS specifically states that the US will develop missile defenses and will take preemptive actions against emerging threats before they are capable of harming the nation. This is reinforced at multiple points in the strategy, stating that the US will act alone or with allies to identify and destroy threats

before they reach US borders. This inherently includes ballistic missile threats to sovereign soil abroad, such as embassies, military installations, and naval vessels. Although the US does not maintain an embassy in Taiwan, the American Institute in Taiwan was created as part of the *Taiwan Relations Act* and performs similar functions. This institution is largely funded by the US Department of State and is subject to US congressional oversight.

Proliferation: Threat and Response

This 2001 publication from the Office of the Secretary of Defense clearly outlines the US goals and interests in Northeast Asia--primarily those tied to the protection of citizens and economic interests in the region. This document also focuses on the regional ballistic missile threats, citing North Korea and China as the greatest concerns due to their continued emphasis on WMD and ballistic missile development. This proliferation of ballistic missile technology and production of components not only has a direct effect on the stability of the Northeast Asia region, but also affects many other parts of the world as the technology and hardware are exported for profit (Office of the Secretary of Defense 2001, 8). China's positioning of large numbers of ballistic missiles opposite Taiwan is the proximate cause of Taiwan's need for JTMD support.

The Quadrennial Defense Review

The major political and strategic elements of the 2002 *NSS* are nested in the *Quadrennial Defense Review (QDR)*. However, this document reflects the military perspective and outlines a number of national interests. Specifically, the *QDR* states that the following are considered "enduring national interests" that must be addressed by the elements of national power:

Ensuring US security and freedom of action, including: safety of US citizens at home and abroad. Honoring international commitments, including: security and well being of allies and friends; precluding hostile domination of critical areas - particularly Europe, Northeast Asia, the East Asian littoral, and the Middle and Southwest Asia. (The East Asian littoral is defined as the region stretching from south of Japan through Australia and into the Bay of Bengal). Contributing to economic well being, including: vitality and productivity of the global economy; security of international sea, air, and space, and information lines of communication; and access to markets and strategic resources. (*QDR* 2001, 2)

Collectively, the US government documents above provide the guidance, framework, and stated national interests that will inform JTMD policy recommendations. The next consideration is the application of prevailing theoretical constructs in order to better evaluate possible employment solutions.

Prevailing Theories of International Relations

An objective analysis of the Taiwan issue requires some degree of understanding of the prevailing theories of international relations. The two main constructs that frame the way in which diplomats, scholars, and soldiers view the relationships between nation-states are “realism” and “idealism.” Although rarely stated outright, the influence of these two schools of thought is often clearly distinguishable in policy and in practice. It is therefore necessary to address the fundamental concepts of each so that their influence is recognized and attributable when considering sources and conducting analysis. This thesis primarily uses the works of Michel Doyle, Hans Morgenthau, and Peter Katzenstein to apply these theoretical constructs to US interests in the Taiwan scenario.

Realism

Realist theory is marked by the underlying conviction that nation-states exist in a chaotic international system that has no order other than that defined by relative power. Realists contend that the interests of the state are distinguishable from those of private

citizens and groups within the state and that the interest of the state are dominant (Doyle 1997, 43). Within this environment, realism dictates that the state will objectively determine and pursue its interests as the only true means of providing for its security. This theory is frequently associated with and epitomized by the works of Hans J. Morgenthau.

Referred to as the “philosophy of force,” realism does not recognize any legitimate claims to international law and order other than that which is dictated by relative power. Realists contend that this international condition explains the need for states to form temporary security alliances geared towards the mitigation of their mutual insecurities (Doyle 1997, 43). In this context, states do not have enduring friends or allies, only enduring interests.

Idealism

Idealism or liberalism is the other prominent construct of international relations theory. Idealists contend that morals and ethics are key factors in determining national interests and that a state’s primary motives are not based on the use of relative power to achieve security (Nuechterlein 2001, 8). Liberalism focuses more on the normative context of political and strategic action and contends that norms, laws, and agreements are sufficient for creating a binding order in the international system (Katzenstein 1996, 25). While realists are often referred to as “hawks,” idealists are normally associated with political and strategic positions that favor the use of diplomacy, economics, and information, over the use of military force when contemplating application of the elements of national power. This position places significant importance on the ability and

capability of states to cooperate and generate frameworks that are mutually beneficial to both nations.

Other Theoretical Constructs

The Security Dilemma

The security dilemma construct attempts to explain how proliferation occurs between states as each seeks to ensure its own security. The dilemma arises when one state, in the course of seeking self-security, inadvertently causes another state to feel threatened. The threatened state then responds by increasing its security posture or arsenal to a point it feels is commensurate with the position of the first state. When repeated, the process results in a potentially endless proliferation, all in the search for security and stability (Collins 1997, 1-2). This theoretical dilemma is pertinent to this thesis as both China and North Korea have outwardly stated that they view the establishment of missile defense systems in the region as a destabilizing threat.

An abundance of existing literature describes the security dilemma concept and provides examples of its application. For the purpose of this thesis, the author uses Alan Collins' *The Security Dilemma and the End of the Cold War* as a basis for describing the constructs and applying the theory to the analysis. The author also uses John Herz's article, "Idealist Internationalism and the Security Dilemma" from *World Politics* to evaluate the different ways in which states may react when faced with a security dilemma.

As the security dilemma proposition existed during the days of the Cold War, there has been a significant amount of study and writing on ways to avoid or overcome the dilemma. A 1999 article in *International Security* titled "The U.S.-Japan Security

Alliance and the Security Dilemma in East Asia” explores ways in which a security dilemma can be avoided through the presence of stabilizing factors that bring a degree of security and stability to all states involved (Christianson 1999, 54). Additionally, a 1978 article in *World Politics* titled, “Cooperation Under the Security Dilemma” explores how cooperative policies and mutually beneficial security arrangements can help mitigate a security dilemma (Jervis 1978, 167-168). The author applies these theoretical approaches to the current security dynamics between the US, China, and Taiwan in order to conduct analysis and answer the primary thesis question.

National Interests

Because the term national interests is used in various contexts, specifically within debates over the realist and idealist theories of international relations, it is necessary within the scope of this thesis to define its precise meaning. The work of Donald Nuechterlein, specifically his model for determining national interests, is used within this thesis to maintain a single standard of objectivity and consistency. Nuechterlein divides the three main categories of interests as: national interests, which are external and are determined by the president and congress; strategic interests, which are second order interests that are concerned with the political, economic, and military means of protecting the country against military threats; and private interests that are pursued by business and other organizations operating abroad (Nuechterlein 2001, 12). This thesis is primarily concerned with national interests, which Nuechterlein further divides into changing and enduring interests. His work and methodology are further expanded upon in chapters 3 and 4.

Literature Base for Meta-analysis

The meta-analytical method of this thesis is described in detail in the next chapter. However, it is sufficient to state at this point that this research method is reliant on the findings and recommendations of independent but homogeneous studies produced by three well-established and respected “think tanks”: The Research and Analysis (RAND) Corporation, The Henry L. Stimson Center, and the Center for Strategic and International Studies (CSIS). The reports and analyses from these organizations are independent in the respect that they represent the original finding of highly qualified working groups. They are homogeneous in the respect that they each specifically deal with the Taiwan security issue, in the contemporary operating environment context. The consolidated findings of these institutions represent an informed and balanced perspective on the dynamics of the US-Taiwan-China dynamic.

It is significant to note that both realist and idealist theories inherently influence the findings and recommendations of these studies. However, none of these studies are exclusively dominated by a single construct, and each is created with the stated intent of nonpartisan objectivity. They are therefore treated as homogenous for the purpose of the meta-analysis in this thesis.

RAND Corporation

The RAND Corporation was initially established in 1946 as a research and analysis engine for the US Air Force. Since then it has established itself as the first and premier think tank working in the public interest to improve policy and decision making through research and analysis. As a nonprofit organization, RAND supports all branches of the armed services and sets corporate standards for high quality, objectivity, and

innovation. RAND's corporate mission statement summarizes the critical elements that insure its credibility as a source: develop innovative solutions to complex problems by bringing together researchers in all relevant academic specialties; achieve objectivity by avoiding partisanship and vested interests; meet the highest technical standards by employing advanced empirical methods and rigorous peer review; and serve the public interest by wide dissemination of publications (Rand Corporation 2003).

Specifically, RAND Issue Paper 181, *Planning a Ballistic Missile Defense System of Systems*, and RAND publication *Dire Straits: Military Aspects of the China-Taiwan Confrontation and Options for US Policy* form the basis for input to the meta-analysis. Both studies are relatively recent, 1999 and 2000, respectively. Collectively, they provide a holistic and objective assessment and analysis of the US-Taiwan-China security issue and provide specific recommendations for application of all elements of US national power. Of particular interest to this thesis, they offer a thorough assessment of JTMD implications as well.

The Stimson Center

Founded in 1989, the Henry L. Stimson Center is a nonprofit, nonpartisan institution devoted to enhancing international peace and security through analysis and outreach. The mission of the center is to offer practical solutions to the problems of national and international security through quality research projects. Its stated vision is “a world in which instruments of security cooperation and peace overtake historic tendencies toward conflict and war” (Henry L. Stimson Center 2003). In support of this mission and vision, the center maintains the following objectives of, “combining analysis with carefully designed outreach, dialogue, networks and partnerships to achieve greater

impact; conducting analysis that is independent, creative, anticipatory, and integrative; viewing a nonpartisan, non-ideological approach to issues as one of our greatest strengths; and conducting a constant, rigorous self-assessment of our work, both as an institution and as individuals” (Henry L. Stimson Center 2003).

Specifically, Stimson Center Report 34 *Theater Missile Defenses in the Asia-Pacific Region*, and Stimson Center publication *China and Missile Defense: Managing US-PRC Strategic Relations* form the basis for input to the meta-analysis. Similar to the RAND reports, these studies provide a detailed holistic analysis of the issues relevant to this thesis and focus specifically on the impact of JTMD on national and regional security and stability.

Center for Strategic and International Studies

CSIS is a Washington, DC based, private, nonpartisan organization; that is led by former Deputy Secretary of Defense John J. Hamre; and is guided by a board of trustees consisting of prominent individuals from both the public and private sectors. The center’s mission is to provide world leaders with strategic insights on, and policy solutions to, current and emerging global issues. CSIS researchers focus primarily on: challenges to national and international security; maintaining resident experts on all of the world’s major geographical regions; and helping to develop new methods of governance for the global age (Center for Strategic and International Studies 2003).

Specifically, the CSIS prospectus *Taiwan: Maintain the Current Ambiguity* and CSIS Pacific Forum reports *The Shadow of Kosovo Looms Large* and *US-Japan Strategic Dialogue: Beyond the Defense Guidelines* form the basis for input to the meta-analysis. Each of the three reports was published between 1999 and 2001, a timeframe comparable

to the RAND and Stimson Center reports, and is appropriately focused and objective in nature. Although the Taiwan issue is not the central focus of the CSIS Pacific Forum reports, it does receive significant attention and analysis that is sufficient for the purpose of this thesis.

Other Current and Credible Sources

Because of the rapidly changing circumstances in Northeast Asia, and in the world in general, it is necessary to continuously analyze the contemporary operational environment. As the ultimate goal in addressing the Taiwan issue in the context of this thesis is to develop a military component to a policy recommendation, that recommendation must be based on current facts and existing conditions in order to be valid. In order to remain abreast of current information in the region the author references a number of reliable and official sources that provide reliable, consistent, and balanced information.

American Foreign Policy Council

The American Foreign Policy Council (AFPC) disseminates the *Missile Defense Briefing Report* on a weekly basis as a professional forum for all missile defense related activities and issues. While its focus is global, most issues of the report deal with some aspect of Northeast Asia, frequently China and Taiwan. This forum has proved especially useful in tracking the status of Chinese and North Korean nuclear and ballistic missile programs and their respective exportation of missile components and technology. This source is used in this thesis, only as needed, to ensure and clarify information and events that may have superseded sources used in the meta-analysis.

Center for Nonproliferation Studies

The Center for Nonproliferation Studies (CNS) at the Monterey Institute of International Studies, in Monterey, California, maintains the online document *Ballistic Missile Defense in Northeast Asia: An Annotated Chronology, 1990-Present*. This document is updated monthly and tracks ongoing summits, security arrangements, and significant events as they pertain to the proliferation of ballistic missiles in Northeast Asia. Similar to the AFPC's *Missile Defense Briefing Report*, this source provides accurate and current information that is subjected to the academic standards of its sponsoring institution. As the stated goal of CNS is to combat the spread of WMD by training the next generation of nonproliferation specialists and disseminating timely information and analysis, this source is only used in this thesis for the purpose of obtaining current objective information.

Conclusion

The purpose and intent of outlining and discussing the literature that is used in this thesis is threefold. The ultimate aim of this work is to answer the primary thesis question in an objective and nonpartisan manner. Each of the sources selected as input to the meta-analysis is therefore selected based on their established and documented embodiment of these concepts. Second, theoretical constructs of international relations theory are discussed to illuminate their inherent manifestation in all conclusions and policy recommendations. As these represent embedded and inseparable bias in professional opinions, their presence does not necessarily represent a lack of objectivity, but merely a tendency towards either end of a theoretical spectrum. Third, the range of literature and subject matter experts is highlighted to demonstrate that an appropriate

body of diplomatic, academic, and military authorities has been consulted in the research and analysis of this work. As a result, this work will present a solid, objective, nonpartisan conclusion based on the established works of a cross section of experts.

CHAPTER 3

RESEARCH METHODOLOGY

The research method for this thesis relies, in part, on the clear understanding of national interests which are defined in chapter 2. The author uses a modified version of Donald Nuechterlein's "national interest framework" to assess the relative interest of the US in an independent and democratic Taiwan. Once the intensity of US interests are established, the author will use meta-analysis to evaluate three homogeneous sets of studies to derive answers to the secondary and tertiary questions. These answers will aid in formulating an answer to the primary thesis question. The correlations and commonalities resulting from the meta-analysis, in the context of US national interests, will form the basis for ensuring this policy recommendation is comprehensive and informed.

National Interest Frameworks

Nuechterlein Framework

Donald Nuechterlein's national interest framework recognizes that the US, like all countries, has both changing and enduring interests. With regard to enduring interests, he specifically cites four that have developed over the history of the nation and have shaped the historic foreign policy decisions of the government:

Defense of the US and its constitutional system; Enhancement of the nation's economic well being and promotion of US products abroad; Creation of a favorable world order (international security environment); and Promotion abroad of US democratic values and the free market system to include implications for American trade, investment, access, maintenance of US dollar value, preservation of standard of living, and concerns of trade deficits. (Nuechterlein 2001, 16)

US Army War College Framework

This thesis will use a modified version of the Nuechterlein framework that was developed and is in use at the US Army War College (USAWC), in Carlisle Barracks, Pennsylvania. The USAWC framework uses categories similar to those of Nuechterlein to assist in organizing an analysis. Both frameworks concede that any given interest may have implications in more than one category. The four categories of the USAWC framework are:

1. Defense of Homeland: This refers to protection against attack on the territory and people of a nation-state in order to ensure survival with fundamental values and political systems intact.
2. Economic Prosperity: This refers to the attainment of conditions in the international environment that insure the economic well being of the nation.
3. Promotion of Values: This refers to the establishment of the legitimacy of or the expansion of the fundamental values of the nation such as free trade, human rights, democracy, etc.
4. Favorable World Order: This refers to those end states that promote conditions that are favorable to the values and fundamental purposes of the nation, such as stability and democratic governments. (Yarger and Barber 1997, 118-125)

Intensity of Interests

The challenge in assessing the intensity of US interest in the Taiwan scenario is not in identifying which of the four enduring interests are involved, but in determining and analyzing the intensity of the interest at stake (Nuechterlein 2001, 17). This determination is fundamental as it is a critical factor in determining the appropriate policy response for the issue. For this purpose, the author will use the matrix described in table 1. Within the matrix, the author will determine the US stake in terms of each enduring interest and then estimate the intensity of Taiwanese and Chinese interests in the same issue. This comparison will be used to augment the results of the meta-analysis matrix in

determining whether a specific recommendation is likely to end with negotiations or if it is likely to lead to military conflict.

Table 1. Methodology: National Interest Framework				
Basic National Interest	Intensity of Interest			
	Survival (Critical)	Vital (Dangerous)	Important (Major) (Serious)	Peripheral (Bothersome)
Defense of Homeland				
Economic Well being				
Favorable World Order				
Promotion of Values				

Source: Nuechterlein 1999, 21.

Levels of Intensity

Both the Nuechterlein and USAWC frameworks view the intensity of interests as a means of determining the priority of critical interests. Without this prioritization, the potential exists for a state to mismatch its resources with its strategic objectives (Yarger and Barber 1997, 118-125). The USAWC framework acknowledges the following three levels of intensity and describes them in the context of the question; what happens if the interest is not realized?

1. Vital: If unfulfilled, will have immediate consequences for critical national interests.
2. Important (Major): If unfulfilled, will result in damage that will eventually affect critical national interests.
3. Peripheral: If unfulfilled, will result in damage that is unlikely to affect critical national interests. This intensity level does not imply that the interest will not be

addressed – merely that its relative significance to the national well being is such that it may not warrant immediate action or recourse. (Yarger and Barber 1997 118-125)

Reconciling Two Methodologies

The primary difference between the Nuechterlein and USAWC frameworks, besides the term “major” vice “important,” is the absence of “survival” as a level of intensity in the latter. This deliberate exclusion is likely due to the assumption that the US has not faced a survival threat since the fall of the Soviet Union in 1991. However, as the Taiwan scenario has the potential to engage the US with a nuclear-armed China, the author includes “survival” as a potential category for analysis. This category is shaded on the table 1 matrix to indicate that this level of intensity is highly unlikely and that maximum care must be taken to avoid policy recommendations that will necessitate this consideration.

Determining Vital Interests

In the event that US interests fall on the line between “vital” and “important (major),” the author will further refine the US position using Nuechterlein’s table of value and cost factors displayed in table 2. Within the table, a high, medium, or low rating is applied to each of the value factors and each of the cost factors. To further quantify the results, a numerical value of 1 is attached to a “low” assessment, a value of 2 is attached to a “medium” assessment, and a value of 3 is attached to a “high” assessment. If the resulting sum of the value factors is high and the sum of the cost factors is low or medium, the level of US interest is likely to be vital. If the resulting sum of the value factors is low and the sum of the cost factors is high or medium, the level of US interest is likely to be important but not vital. The assignment of numerical values to

the factors generates a ratio that is useful in quantifying a specific intensity of US interest in this scenario. The significance of this determination is that vital interests must be addressed appropriately in policy (Nuechterlein 2001, 26-27).

Table 2. Methodology: Determining Vital Interests			
Value Factors		Cost/Risk Factors	
Proximity of the Danger		Economic cost of Hostilities	
Nature of the Threat		Estimated Casualties	
Economic Stake		Risk of Enlarged Conflict	
Sentiment Attachment		Cost of Protracted Conflict	
Type of Government Aided		Cost of Defeat or Stalemate	
Effect on Balance of Power		Adverse International Reaction	
National Prestige at Stake		Cost of US Public Opposition	
Support of Key Allies		Risk of congressional Opposition	
Total Value Factor		Total Risk Factor	

Source: Nuechterlein 1991, 26-27.

Meta-analysis

The author of this thesis applies a qualitative meta-analysis as the primary means of addressing the research question. Gene Glass developed this method in 1976 as a means of analyzing research topics where an unmanageable amount of research and studies already exist. This method is described as “the analysis of analysis or the statistical analysis of a large collection of analyses for the purpose of integrating the

findings” (Glass 1979, 3). Using this method, the author critically analyzes commonalities in the selected studies within the context of US national interests. The factors used in this analysis are drawn from the secondary and tertiary research questions and are designed to narrow the focus of the research towards answering the primary question.

Method Selection Rationale

The author selected this method for two main reasons. First, the vast body of research on the US-Taiwan-China dynamic renders the topic susceptible to serious political and theoretical bias. The three sources selected as input for meta-analysis, RAND, The Stimson Center, and CSIS, are described in detail in chapter 2. They were each selected based on their nonpartisan objectivity and documented expertise of their respective work groups. The studies used in this analysis are therefore objective subsets of the larger body of research on the topic. Secondly, the use of the Neuchterlein-based USAWC national interest framework, as well as the author’s previous research in missile defense and Asian security studies, enable a critical analysis of the commonalities of these studies to form effective conclusions.

The Meta-analysis Process

The first step in a meta-analysis is to locate and research an appropriate number of qualified studies. The second step is to select the studies that will be utilized in conducting the analysis. Both of these steps have been accomplished and thoroughly documented in chapter 2. The RAND, Stimson Center, and CSIS studies used in this thesis were specifically selected for their comprehensive characteristics, objectivity, and nonpartisan content.

The next series of steps in the meta-analysis, abstraction and analysis, are illustrated in detail in chapter 4. The meta-research model in table 3 is the primary vehicle for recording this process. The “factors” in the model represent the abstraction of commonalities within the studies. These factors also relate specifically to the secondary and tertiary question of this thesis. While all listed factors may not directly apply to a specific study, the factors are generally selected based on their applicability to both the thesis question and the ability of each study to contribute to analysis and formation of conclusions.

The Random Effects Model

For the purpose of analysis, the studies from the three stated think tanks are considered homogenous and it is therefore appropriate to combine their commonalities and treatment of relevant subject matter. Additionally, as this thesis will consider both the variability within the studies themselves and between the different studies, this analysis can be considered a random effects model. As the goal of this thesis is to provide an independently determined policy component on the deployment of US JTMD systems in support of Taiwan, the final deliverable of this document is a recommendation that will produce a benefit to the US under most circumstances. Conversely, if the goal of this thesis were to select which of the three studies would best suit the interests of the US, a fixed effect model would be more appropriate. However, this option is limited in that it would only provide an appropriate policy recommendation within the context of one specific study and would therefore be little more than an endorsement of that think tanks’ position on the Taiwan issue (Petitti 1994, 92).

Meta-analysis Model

The model displayed in table 3 illustrates the conceptual basis for the abstraction and meta-analysis in this thesis. As stated, the factors along the left hand column represent the abstraction of study commonalities as well as the elements that are essential to addressing the applicable questions in this thesis. The columns under each study heading will contain a brief narrative to indicate how the relevant factor is treated within each respective think tank's studies. These studies, as well as the abstracted factors, were selected with the express intent of limiting empty boxes, which would represent an area that is not addressed by a specific study.

Table 3. The Methodology of Meta-analysis			
Factors	RAND	Stimson Center	CSIS
Combined / Interoperable JTMD			
US Only JTMD in Support of Taiwan			
Taiwan Only JTMD			
PRC Reaction to Combined / Interoperable JTMD			
PRC Reaction to US JTMD in Support of Taiwan			
PRC Reaction to Taiwan JTMD			
Significant Issues and impediments			
Systems considered			

CHAPTER 4

ANALYSIS

The goal of this chapter is to first identify the extent and intensity of US interest in an independent and democratic Taiwan and then determine a recommendation that applies the appropriate JTMD policies, procedures, and resources to adequately address the interest. The author clearly acknowledges that it is the President of the United States and his security advisors that must make the fundamental judgment about the intensity of US interests and decide on an appropriate course of action. By definition, US interests in Taiwan are only considered vital when the President concludes that the issue at stake is so fundamental to the political, economic, and social well being of the US that it should not be compromised, even if this conclusion results in the use of economic and military sanctions (Nuechterlein 2001, 26). The following analysis is therefore offered as an informed opinion based on the meta-analysis of established research products.

Determining National Interests

As described in chapter 3, table 4 outlines the relative interest of the US, China, and Taiwan in an independent and democratic Taiwan. The relative importance of this issue, to both China and Taiwan, has remained fairly constant since the ratification of the *Taiwan Relations Act* in 1979. Therefore, their respective interests are fairly predictable. Taiwan desires unconditional independence and China insists on a “One China” policy that makes Taiwan part of the mainland. From a US perspective, the primary policy goal is the peaceful resolution of conflict in the Taiwan Strait. Therefore, it is not necessarily the interests of the three involved parties but the intensity of these interests that requires clarification.

Intensity of Interests

Both the US and China have enduring interests that rest on the dividing line between “vital” and “important.” Table 4 illustrates how US and Chinese interests lie on both sides of this theoretical line. The policy implications of choosing either side of this line are fundamental because each country must be prepared for an armed confrontation with the other, if other measures fail, once its leaders have decided that the issue is vital (Nuechterlein 2001, 25-26).

Table 4. Analysis: National Interest Framework				
Enduring National Interest	Intensity of Interest - Democratic and Independent Taiwan			
	Survival (Critical)	Vital (Dangerous)	Important (Major) (Serious)	Peripheral (Bothersome)
Defense of Homeland	Taiwan		China	US
Economic Well being		China, US Taiwan	US, China	
Favorable World Order		China, US	US, China, Taiwan	
Promotion of Values		US	US, China, Taiwan	

Chinese Interests

A critical stabilizing factor in the US-Taiwan-China scenario is that China is not physically threatened by the conflict. Taiwan does not possess the military capability or political will to prosecute a successful campaign against China’s mainland, and China is relatively assured that its strategic nuclear arsenal is sufficient to prevent US aggression outside of the Taiwan Strait. However, considering China’s assertion that Taiwan is

effectively a part of China, “defense of homeland” is significantly important from the Chinese perspective.

Economically, China and all Asia-Pacific countries have a significant interest in maintaining the integrity and security of the Straits of Malacca, as a large volume of the world’s trade uses this sea line of communication (SLOC) (Kerr 1999, 2). The proximity of these trade routes to Taiwan gives China a significant incentive to keep peace in the Taiwan Strait because of the risks to its economic growth. Therefore, despite desiring a “favorable world order” that involves reunification with Taiwan, China currently maintains a stronger “economic well being” interest to maintain the status quo in the Taiwan Strait (Kerr 1999, 4). In short, the tangible economic benefits of relative peace and stability in the region have outweighed the more ideological interests of “favorable world order” and “promotion of values” to date.

Taiwan Interests

As Taiwan is largely the center of this conflict, it is likely the only nation with a true “survival” interest in defending its homeland. In this scenario, any deviation from the status quo either gains Taiwan its independence, or witnesses its absorption into China. This is the primary reason why Taiwan requires the continued support of the US for defense and security. In this context, the introduction of a US JTMD system would likely bear a political significance bigger than its military significance in that it is a tangible sign of US resolve to defend Taiwan (Henry L. Stimson Center Report 2000, vii). This concept must be taken into account as the US considers multiple JTMD options with regard to Taiwan.

“Economic well being” represents a vitally important interest to Taiwan as well. As a small island nation that relies almost exclusively on trade and its adjacent SLOCs to reach the world market, Taiwan shares similar economic interests with China but holds those interest with greater intensity. Taiwan undoubtedly maintains “favorable world order” and “promotion of values” as enduring national interests as well. However, similar to those interests of China, the intensity of interest in national survival and the massive economic benefits gained from maintaining the status quo have continue to take priority in policy decisions and actions.

US Interests

It is not surprising that the US-Taiwan-China issue is one that consumes a significant amount of time and effort of policy makers and the US National Security Council. The challenge here is in reconciling that the US stake in this foreign policy problem is so great and the Chinese position so adamant that resolution through negotiation and compromise appears doubtful. Although it is clear that this situation does not physically threaten the survival of the US, its economic implications are extremely significant. Over a half million US citizens live, work and study in East Asia; US based businesses conduct more than \$500 billion in annual trade; and US investors have over \$150 billion invested in the region (Office of the Secretary of Defense 2001, 7).

Additionally, as compared to China and Taiwan, the US holds “favorable world order” and “promotion of values” far more intensely. The US has stated goals of political and economic freedom, peaceful relations with other states, and respect for human dignity; and has publicly stated its commitment to the *Taiwan Relations Act* in support of these ideals (Bush 2002, 1-2). The 2002 NSS encourages increased economic freedom as

a means of building national wealth and social and political freedom as a means of building national greatness. However, the strategy also states that China has not yet made the fundamental decisions that will define the “character” of the Chinese state and that its pursuit of advanced military capabilities will hamper its “pursuit of national greatness” (Bush 2002, 27). These stated indicators warrant further analysis on the intensity of these enduring US interests.

Intensity of US Interests

To definitively determine the interests of a state requires a conclusion, by the leader and his advisors, that additional compromise on the issue is not a consideration. This clearly defines the issue as vital (Nuechterlein 2001, 26). However, it is likely that this determination may vary with the current world political environment, economic indicators, relative stability, and different political administrations. Accordingly, table 5 outlines an objective nonpartisan analysis of the US-Taiwan-China issue in terms of US value and cost factors. This output represents the intensity of US interests in the scenario and will be integrated into the subsequent meta-analysis.

Table 5. Analysis: Determining Vital Interests			
Value Factors		Cost/Risk Factors	
Proximity of the Danger	Med (2)	Economic cost of Hostilities	Low (1)
Nature of the Threat	High (3)	Estimated Casualties	Low (1)
Economic Stake	High (3)	Risk of Enlarged Conflict	High (3)
Sentiment Attachment	Low (1)	Cost of Protracted Conflict	Med (2)
Type of Government	High (3)	Cost of Defeat or Stalemate	Med (2)

Aided			
Effect on Balance of Power	High (3)	Adverse International Reaction	Low (1)
National Prestige at Stake	Med (2)	Cost of US Public Opposition	Low (1)
Support of Key Allies	High (3)	Risk of congressional Opposition	Low (1)
Total Value Factor	Med/High (2.5) 20	Total Risk Factor	Low/Med (1.5) 12

Value Factor Analysis

Despite the geographic separation of the US from Asia, the proximity of danger in this scenario still represents a medium risk to the US. This is primarily due to the stationing of a large number of US troops in the region, such as the 2nd Infantry Division in South Korea; the US 7th Fleet in Yokohama, Japan; and the 1st Marine Expeditionary Force in Okinawa, Japan. For similar rationale, the nature of the threat and economic stake for the US warrant a high value factor rating as well.

US trade interests with China, Taiwan, and their adjacent sea routes are critical to the US economy and regional stability. The *2002 NSS* states, “a return to strong economic growth in Europe and Japan is vital to US national security interests” (Bush 2002, 18). This is clear guidance that East Asia must be secure and stable as a precondition for the attainment of this security objective. This is echoed in the *QDR* which states the enduring US interest in, “precluding hostile domination of critical areas, particularly Europe, Northeast Asia, the East Asian littoral, and the Middle and Southwest Asia” (Department of Defense 2001, 2). Therefore, any significant conflict in the Taiwan Strait would undoubtedly have negative economic impacts on all countries involved as well as on all

other nations in the region that depend on the stability of trade routes and SLOCs south of Taiwan and China. A recent manifestation of the importance of economic stability in the region is the US support for the accession of both Taiwan and China to the World Trade Organization (Bush 2002, 26).

Other significant value factors at stake in this situation are those that are less tangible. Although the US government does not normally tie significant sentiment to its policy decisions, there is a strong tradition of US support for democracy in the world. The US has stated its intention to, “preserve the peace by building good relations among the great powers and extend the peace by encouraging free and open societies on every continent” (Bush 2002, iii). The US has fully supported its defense obligations to Taiwan since the signing of the *Taiwan Relations Act* in 1979 and continues to honor its international commitments, including the security and well being of allies and friends (Department of Defense 2001, 2). This resolve in itself is evidence of the value that the US places on preserving the balance of power, defending national prestige, and supporting friends and allies.

In summary, the US places a medium to high value on its commitment to supporting Taiwan and strongly supports the larger aim of protecting the stability of East Asia. To quantify this value, the sum of all value factors (20) is divided by the number of value factors (8), for an average of 2.5.

Risk Factor Analysis

In the event that the US must take military action in the defense of Taiwan, both the economic cost of hostilities and the estimated casualties are likely to be relatively low. The most probable military response from the US to Chinese aggression towards

Taiwan would be a naval and air-based force that would conduct precision strikes and deterrence via surface launched missiles and precision air dropped munitions. Since the US has no interest in offensive ground operations in China, standoff weapons that do not put US soldiers in direct danger could realize the majority of desired effects. Given the exceptionally high cost of a nuclear engagement for China, there is little evidence to suggest that such an operation would cross the nuclear threshold. The US nuclear missile arsenal overmatches that of China to the degree that a Chinese counterforce attack is unfeasible and a countervalue attack would yield a catastrophic response from US weapons (Mulvenon 2002, 58). An asymmetrical nuclear engagement such as this would ensure the destruction of China, but would not guarantee any degree of strategic effect on the US.

Opposed to the most likely course of events described above is the potential for a prolonged conventional conflict that escalates into a full theater war. Maintaining the assertion that the conflict remains below the nuclear threshold, China does possess the capability and resolve to remain engaged in a conventional conflict for an extended amount of time. This course of events would undoubtedly increase the costs to the US in terms of both dollars and casualties. However, the main factor offsetting this potential situation is the massive economic opportunity cost that China would be forced to absorb by initiating such an action. Therefore, the likelihood that China will initiate aggressive actions against Taiwan, to the extent that the US must act militarily, is low. However, the potential that these actions could lead to a protracted conventional conflict is high to all actors involved, including the US. Additionally, the potential for a conventional conflict to result in a stalemate is also a significant risk factor for the US.

In the event the US is provoked to take military action against China, it is likely to be done with the support of the American people, congress, and the international community. The US has maintained its support to the *Taiwan Relations Act* since 1979 and has consistently stated its interest in a peaceful resolution between China and Taiwan (*Taiwan Relations Act*, Sec 3302). The US has supported Taiwan's defense needs for the past 25 years with little domestic or international dissention other than that from China. Therefore, it is unlikely that US public opinion, or world opinion, would object to the US acting on these longstanding policies. Chinese aggression towards Taiwan would likely be viewed similarly to Iraq's invasion of Kuwait in 1990, an action that drew international condemnation and bolstered support for a US-led coalition to counter the attack and restore preconflict borders.

In summary, the US realizes a low to medium risk in its commitment to supporting Taiwan with the larger aim of protecting the stability of East Asia. To quantify this value, the sum of all risk factors (12) is divided by the number of risk factors (8), for an average of 1.5.

Value and Risk Analysis

As stated in chapter 4, when the sum of value factors is high, and risk factors low, the level of interest in the area is likely to be vital. In table 5, the value to risk ratio is 20:12 and can be reduced to 2.5:1.5. This ratio strongly indicates that the value of supporting Taiwan's defense against China clearly outweighs the risks involved. However, since the average of value factors falls on the medium to high line, and the average of risk factors falls on the medium to low line, this method cannot definitively define the interest as vital. What this does indicate is that US interests in supporting

Taiwan are considerable and that even a slight increase in value factors, or decrease in risk factors could solidify the interests as vital.

The major reason that US JTMD support to Taiwan has been so contentious is that it has the potential to affect this fragile ratio. To ignore the Chinese proliferation of ballistic missiles oriented on Taiwan leads unquestionably to a decrease in value factors to the US. The US would lose economically as the balance of power shifts in favor of China, politically as national prestige is diminished by a lack of support to a key ally (Taiwan), and militarily as the proximity and nature of the TBM threats from China gain the capability to affect US forces in South Korea and Japan. Conversely, an overly aggressive JTMD deployment could significantly increase the risk factors to the US. As addressed previously, there is a danger of provoking China into a prolonged conventional conflict that may prove costly in terms of sustaining military operations as well as lost economic opportunities. Essentially, this analysis determines that Chinese TBM threats to Taiwan must be addressed by the US in a manner that will not provoke China into a protracted conventional engagement.

Meta-analysis

The initial conclusion of the analysis suggests that the US has a “near” vital interest in defending Taiwan against Chinese TBM threats. The intensity of this interest therefore requires some type of action to protect value factors and reduce risk factors (Nuechterlein 2001, 25-26). The next step in the analytical process is to assimilate the findings of the selected meta-analysis studies. These studies, from RAND, the Stimson Center, and CSIS are outlined in detail in chapter 2. For the purpose of simplifying analysis, the completed meta-analysis chart, described in chapter 3, is presented in table 6

with an abbreviated summary of how each study treated the respective issues. The treatment of each study and factors are discussed in detail in the subsequent analysis narratives. In some cases, not all studies address the JTMD issue in the same format or context as that of this thesis. However, all studies provided a fairly comprehensive treatment of the majority of issues that bear on the problem. As the research methodology chapter for this thesis determined, this method of analysis will yield a comprehensive assessment of the Taiwan JTMD issue that is objectively focused.

Table 6. Meta-analysis			
Factors	RAND	Stimson Center	CSIS
Combined / Interoperable JTMD	Some – Info and intel sharing Coalition type Def w/o direct int. of systems	No, but- coord w/ Taiwan on joint warfare, C4I, crisis comms / CONPLANs	No – threatens China – viewed as a China containment strategy
US Only JTMD in Spt. of Taiwan	US NMD may provide residual coverage to Taiwan	US NMD may provide residual coverage to Taiwan	US must have JTMD if drawn into conflict
Taiwan Only JTMD	Yes, Qualitative superiority offsets numerical infer in def ops. US offer C4I	Yes, Strategic EW, hardening of C4I not sufficient “Preemptive def” - LACMs and ATG	No, Reliable defense not possible Modest US sales – only enough to send PRC message
PRC Reaction to Combined / Interoperable JTMD	Tension due to incremental steps to integration Transparent steps	Fear of new US - Taiwan partnership US-PRC dip crisis - tensions	Increase missile arsenal and decoys Off – Def arms race
PRC Reaction to US JTMD in Support of Taiwan	NMD residual OK but JTMD would “strike at the heart of sovereignty”	View as threat to strat. nuc. forces Fear of new US - Taiwan partnership US-PRC dip crisis	Use of IW and TBM coercion Reunify T-line Can’t invade if US fights
PRC Reaction to Taiwan JTMD	Imprudent to attack Odds increase if US gets involved	Increased tensions in the strait	If JTMD is aggressive PRC may Accel. Reunify T-line

Significant Issues and Impediments	Point solution Ctr. measures TMD tied to NMD ABM	No open sales, upper tier, or off. cap. Degrade TBMs is a US pol. obj. Technical feas.	Peaceful res. goal US needs PRC for N. Korea Technical feas. ABM
Systems Considered	PAC3, NA, THAADs, NTW, ABL	Offensive Ops – LACM, ATG, SOF Passive Measures	PAC2/3, NTW – Aegis w/ SMII, THAADs, ABL

Combined and Interoperable JTMD

Independent Support

Each of the three sets of meta-analysis studies concurred that a US-Taiwan interoperable JTMD shield is neither advisable nor necessary. With that conclusion, most of the studies advocate some level of technology transfer, training support, and intelligence sharing between the US and Taiwan on an ongoing basis. This close coordination and cooperation would prove militarily and politically useful in providing a shared perspective on Chinese activities and intentions. However, in terms of interoperability, the US and Taiwan would likely fight independent campaigns against the Chinese in the event of a Taiwan Strait conflict. This becomes an issue of hardware, software, and money; and is largely due to the impracticality of linking US surveillance and targeting systems, such as the Airborne Warning and Control System and Aegis radar, to Taiwanese counterparts (Shlapak, Orletsky, and Williams 2000, 52-53). There are also a myriad of doctrinal, organizational, and training impediments that would render interoperability extremely difficult as well

Limited JTMD Sales

The primary objective of the US in the Taiwan Strait is to support peaceful resolution. On the conservative side, some study groups recommend an extremely limited

sale of lower tier JTMD capability to Taiwan and only to the extent that China receives the political message that US resolve for peaceful resolution remains. The assumption is that strengthening passive defenses and increasing lower tier active defenses best serves Taiwan's security needs (Henry L. Stimson Center 2000, 52). However, this assumption is at significant odds with the consensus that even a significant purchase of PAC 3 systems "would not be capable of providing adequate coverage against a concerted missile attack" (Henry L. Stimson Center 2000, 51). Despite this inconsistency, some studies went so far as to recommend no US interoperability or joint exercises, no upper tier JTMD sales, no naval-based JTMD sales, and no sales of offensive JTMD capability to Taiwan. One glaring shortfall of these recommendations is that they render the Taiwanese leadership incapable of adequate self-defense and the US exclusively responsible for defending Taiwan in the event of a Chinese attack.

Paul Kerr from CSIS claims that changes to US policies towards Taiwan are unnecessary and that the US commitment to the island should be reevaluated for elimination in the future. Although this amounts to extremely limited JTMD sales and minimal interoperability with US systems, this conclusion is reached from an entirely different perspective than that of the Stimson Center findings. Kerr maintains that any additional US support to Taiwan will be viewed by China as a hostile act of containment. This perspective, focused entirely on China, stems mainly from his contention that the US needs Chinese support as leverage against aggressive behavior by North Korea. This view contends that strong trade relations between the US and China, as well as WTO ties, will decrease China's incentive to disrupt peace in the Taiwan Strait (Kerr 1999, 1-2).

US Only JTMD in Support of Taiwan

US JTMD in Layered Defense

Each of the studies considered concludes that the US is prudent to pursue a means of protecting territory, deployed soldiers, and interests abroad from the threat of TBM attack. The RAND study makes a particularly poignant point in stating that, when its vital interests are at stake, the US is not deterred (by TBMs) from intervening abroad.

However, in a scenario such as Taiwan, where US interests are not definitively vital, the lack of a US JTMD capability could render the US deterred by Chinese missiles. In this sense, the US has an operational requirement for JTMD as it enables the nation's ability to act in the defense of a stated friend (Gombert and Isaacson 1999, 5). Additionally, in order to avoid the pitfalls of a point solution, JTMD should be tied to NMD systems as a means of providing boost phase intercept and attaining missile defense synergy. The point solution concept is discussed further under "issues and impediments."

Enabler of Alliance Responsibilities

The majority of study findings acknowledge the importance of JTMD in protecting US forces abroad and implicitly view the facilitation of alliance responsibilities as a legitimate rationale for deployment (Henry L. Stimson Center 2000, iv). However, in the case of Taiwan, the US must assess the value and costs of defending interests that are not definitively vital. Taiwan has a vital interest in a US JTMD deployment in its defense. The political consequences of this in terms of its ability to resist Chinese efforts would likely be of more value to Taiwan than the military capability of the JTMD system to protect the island (Henry L. Stimson Center 2000, 46). From a US standpoint, this deployment must be conducted in support of national interest

objectives, vice those of Taiwan. This strategy ultimately benefits Taiwan as well as it enables the US to honor alliance responsibilities without the threat of coercion from Chinese TBMs.

Taiwan Only JTMD

Qualitative Superiority

One study's recommendation with respect to Taiwan JTMD compares the situation to that of Israel. Faced with a large number of threat missiles in a sustained defensive campaign, Taiwan should retain a qualitative superiority in its JTMD capability. Taiwan plans to purchase PAC 3 batteries in fiscal year 2005 as a supplement to its current PAC 2(+) capabilities in an effort to counter the growing imbalance between China and itself (Berman 2001-2004, Report 118). However, accomplished through close cooperation and arms sales, Taiwan's capability should not be limited to defensive measures only, such as PAC 3, but should also encompass offensive JTMD capabilities via strike aircraft and Air-to-Ground (ATG) missiles. The study also suggests the US should support Taiwan with advanced surveillance radars, command and control (C2) systems, naval surface warfare upgrades, pilot training, and intelligence sharing (Shlapak, Orletsky, and Wilson 2000, 49-50). These types of capabilities must be assessed to ensure they are appropriate to the threat and do not provide a level of overmatch that perpetuates the arms race.

Taiwanese Desire for Attack Operations Capability

Some studies refer to security trends in Taiwan in 2002 that suggest that Taiwan's leadership is becoming increasingly dissatisfied with purely defensive systems and wants to pursue offensive JTMD capabilities as well. Citing reluctance to pursue more PAC 3

batteries and decisions to cancel planned acquisition of strategic early warning radars, one may conclude that Taiwan is moving towards the concept of a more preemptive defense capability (Mulvenon 2002, 56). This potential shift in focus is largely intended to keep armed conflict away from the island itself and provide the capability to strike directly at the source of the threat vice a purely defensive stature. The desire for this capability is strategically sound as evidenced by the fact that attack operations are a primary component of US JTMD doctrine as well. Tang Yao-ming, Taiwan's Minister of Defense, recently stated intentions to pursue a ten-year plan that will include ground, sea, and air-based JTMD capabilities (Berman 2001-2004, Report 93).

US Experience in Attack Operations

However, should Taiwan adopt JTMD attack operations, it is likely to experience many operational challenges revealed by US JTMD deployments. US attack operations during Desert Storm in Kuwait and Iraq and Allied Force in Kosovo exemplified the challenges of using strike aircraft and special operations forces to interdict mobile missile systems; and this challenge is exacerbated when a high density of antiaircraft artillery and missiles exist. This is certainly the case with the Chinese mainland. In lieu of attack aircraft with ATG missile capability, Taiwan may also consider focusing acquisition efforts on land attack cruise missiles (LACMs) as a more preferable and cost-effective option (Mulvenon 2002, 57-58).

Regardless of specific types of systems, even a minimal Taiwanese JTMD attack capability would play a significant role in countering China's coercive TBM posture. Attack operations become increasingly important as China continues development of multiple warhead missiles that exponentially increase the challenge of active defense

systems. China successfully tested a Dong Feng-21 multiple warhead medium range ballistic missile (MRBM) in Shanxi Province in December 2002 (Berman 2001-2004, Report 92).

PRC Reaction to Combined and Interoperable JTMD

Costly War for China

As China is likely to continue its TBM coercion of Taiwan to promote its reunification objectives, deterrence of that TBM threat remains a feasible and viable component of a solution for Taiwan and the US. One study remarks, “Sustaining and enhancing that deterrent, which boils down to sustaining and enhancing Taiwan’s defensive capabilities, is a crucial goal of US-ROC security cooperation” (Shlapak, Orletsky, and Wilson 2000, 56). This study suggests that US support in terms of equipment, training, technology, and political will suffice to meet US objectives of peaceful resolution. This study further suggests that if China did decide on a military solution, it would risk a costly war by attempting to attack or invade Taiwan as a means of accelerating unification; and this risk expands tremendously if the US becomes involved in any capacity with Taiwan’s defense (Shlapak, Orletsky, and Wilson 2000, 56). The author concurs that China is deterred by the prospect of facing the US and Taiwan in a protracted conflict. However, the claim that US equipping, training, and political support are sufficient to achieving the conditions for peaceful resolution is not supported by the current state of events in the Taiwan Strait.

Ambiguity of Attack Operations

In the event that Taiwan shifts its JTMD focus to attack operations, the US must be prepared for additional challenges. In this scenario, the potential for ambiguity is

significantly heightened. Even without interoperability, China will undoubtedly view Taiwanese attack operations as threatening and will likely associate the US with this change in operational tactics. One study highlights the potential for ambiguity using the launch of LACMs against TBM staging areas as an example. The Chinese would not be able to positively ascertain whether the missiles originated from a US submarine or from Taiwan (Mulvenon 2002, 58). The resulting confusion could have negative implications for the US and complicate its goal of peaceful resolution. However, if the US continues to keep an open dialogue with China and supports Taiwanese policies of transparency, this worst case scenario can likely be avoided. Close planning and coordination, C4I interoperability, and contingency planning can still be achieved without further irritation of Chinese security interests.

North Korean Impacts

Another assessment of potential Chinese reactions can be evaluated in terms of the level of attention that the US pays to China vis-à-vis JTMD deployments. Despite the fact that the Chinese may upgrade their missile forces regardless of JTMD deployments, they are almost certain to do so if they feel their security interests are not taken into consideration by US policy. Even if US JTMD systems are oriented on a North Korean threat, China is likely to object via some level of political and diplomatic rhetoric. Depending on the vulnerability perceived by Beijing, the potential range of actions could include, sales of decoy and spoofing device missile technology to North Korea, pulling back from diplomatic efforts to restore peace on the Korean peninsula, resumption of nuclear testing, and increasing its aggressive posture towards Taiwan (O'Hanlon 2001, 128). However, some argue that China may take these actions regardless of JTMD

upgrades as a means of furthering diplomatic goals. As recent as 2003, China was implicated in transferring missile equipment, technology, and expertise to both North Korea and Libya (Berman 2001-2004, Report 123).

PRC Reaction to US JTMD in Support of Taiwan

Reassurance of Strategic Nuclear Capability

Each study generally concurs that, in practice, China recognizes the right of the US to defend its overseas assets from TBM attack. However, when such a JTMD capability is deployed in the vicinity of China's sovereign territory, the issue becomes much more complex. First, the US must reassure China that any US missile defense assets are not deployed in a manner as to threaten the strategic nuclear deterrent capability of China. This is intuitive to some degree as a sea-based JTMD would not be capable of intercepting ICBMs launched from China's interior. This strategic level dialogue increases the probability that any potential conflict will remain limited at the conventional level. Even with this assurance, and the knowledge that China has existed for decades without an assured nuclear second-strike capability against the US, China is likely to continue its proliferation of nuclear ICBM capability (Gombert and Isaacson 1999, 17).

Challenging China's Coercion of Taiwan

The second major issue with US JTMD coverage in the vicinity of Taiwan is that it could be viewed by China as a threat to its sovereignty and its desired ability to coerce Taiwan into reunification (Gombert and Isaacson 1999, 17). However, the intensity of this reaction is likely to be limited, as each study concluded that even with a US JTMD deployment in support of Taiwan, the scenario is highly unlikely to escalate to the

nuclear level. “While the US might be willing to risk war with China to save Taiwan, it is hardly plausible that China would risk its own destruction by launching a nuclear first strike on the US just to acquire Taiwan” (Gombert and Isaacson 1999, 20). China’s limited offensive nuclear capabilities vis-à-vis the robust and capable strategic nuclear capability of the US renders the possibility of nuclear war extremely low in any Taiwan Strait conflict.

Economic Opportunity Costs

Even with the determination that any conflict over the fate of Taiwan will remain at the conventional level, China is unlikely to launch a successful attack on the island, especially if the US intervenes. The most likely course of action is that China will continue information warfare, computer network attack, and TBM coercion as a means of accelerating reunification. With Beijing’s limited opportunity, willingness, and capability to invade Taiwan at such a low state, it is a preferable strategy for the US to support a relative “status quo” that allows the possibility of peaceful resolution. As armed conflict is avoided, the US, China, and Taiwan each increase respective stakes in regional trade, economic prosperity, and commercial endeavors. In this manner, the prospect of armed conflict increasingly raises China’s economic opportunity costs; a situation that further decreases the likelihood that China will conduct offensive operations as a means of reunification (Kerr 1999, 3).

PRC Reaction to Taiwan JTMD

The Status Quo

The Chinese reaction to Taiwanese JTMD can be determined fairly definitively as it lends itself to empirical observation. Taiwan currently possesses a partial JTMD

capability in the form of warning radars and Patriot missile batteries. However, in order to maintain the ability to coerce Taiwan into its reunification timeline, China has continued to increase its TBM arsenal and orient those missiles opposite Taiwan. This Taiwan-centric military modernization program, coupled with aggressive rhetoric and a proven history of intimidating exercises, partially defines the coercive nature of China's reaction to the Taiwanese JTMD capability (Mulvenon 2002, 56). However, this does not exclude the strong possibility that China would continue these actions regardless of Taiwan's capabilities until it achieves its reunification objectives. In this respect, a true status quo does not exist. The number and capability of Chinese TBMs continues to increase at a rate that is not adequately offset by increases in Taiwanese JTMD capabilities. This situation has led to an incrementally expanding Chinese advantage over the past decade.

Political Significance of US JTMD Sales

Because of the importance of the US in Taiwan's defense, any US involvement in Taiwan JTMD will prove bothersome to the Chinese. In this respect, the political consequences of supporting Taiwan with JTMD will likely be as important as the military capabilities of the systems themselves (Henry L Stimson Center 2000, vii). Because of this aspect, the US must remain objective in assessing Taiwan's defense needs and be cognizant that its actions could be perceived as threatening to China. In any possible scenario, it is likely that US-China diplomatic tensions will increase as the US assists Taiwan through JTMD deployment, sales, training, or C4I integration. However, appropriate discretion and situational understanding will facilitate the accomplishment of these necessary tasks without initiating armed conflict with China.

Limited JTMD–Limited TBM Proliferation

With a conservative estimate of 200 Chinese TBMs deployed opposite Taiwan in 2001, the CSIS study group determined that a limited Taiwanese JTMD system is the best way to balance the security concerns of both Taiwan and China (O’Hanlon 2001, 128). By this rationale, a more robust defense on the part of Taiwan could build its confidence to the extent that it would consider declaring independence, an act that would likely induce conflict with China. Conversely, significant increases of Chinese TBMs could make China overconfident in its ability to force a reunification timeline (O’Hanlon 2001, 129). This recommendation essentially mirrors the course of US policy to date. However, much has changed in recent years. China currently has approximately 500 multiple warhead TBMs in range of Taiwan and is expected to increase that to 600 missiles by 2005 (Berman 2001-2004, Report 135). As this 600 TBM benchmark was originally projected to occur in 2007, the increase provides irrefutable evidence that a limited JTMD capability was not met by limited proliferation by the Chinese. In fact, Chinese TBM proliferation increased regardless of Taiwan’s defense measures. The resulting situation is that China possesses a clear TBM overmatch capability that must be countered to protect Taiwan from coercion or attack.

Significant Issues and Impediments

Point Solutions

An interesting issue raised by the RAND study warns of the problems associated with adopting a point solution to the TBM problem. This issue illustrates how the problem of threatening ballistic missiles is more complex and widespread than the China-Taiwan scenario, and therefore must be addressed by a comprehensive solution that looks

beyond the immediate problem. The study suggests, “it is important to explore an entire space of plausible future threats and circumstances as the way of testing the robustness of any solution in the face of uncertainty and change” (Gombert and Isaacson 1999, 5).

While this is clearly a valid concern, it is not representative of the manner in which the US seeks to fulfill its security concerns with respect to JTMD. US JTMD continues to evolve in response to multiple theater threats, such as those in Iraq, North Korea, and China, but it is also a conceptually integrated component of NMD. This holistic concept is not indicative of a point solution and views JTMD in terms of a “System of Systems” based on synergistic layers. In this context, JTMD is a major contributing component to the larger NMD system.

Technical Feasibility

Another significant issue raised by the majority of studies questions the technical feasibility of erecting a leak-proof defense against TBMs. The successful engagement of a TBM requires a multitude of complex tasks that must occur seamlessly for a single successful engagement. Systems must detect the missile launch, classify the threat missile, predict the trajectory, cue additional sensors, track to intercept, assess the kill, and repeat the sequence as required (Gombert and Isaacson 1999, 6). If the system fails at any point, or is overwhelmed with large numbers of targets, it cannot successfully intercept. Additionally, more than one interceptor is typically fired to ensure the successful engagement of a single threat missile. As the number of required interceptors increases proportionately when engaging multiple warhead TBMs, the ability of China to overwhelm active Taiwanese defenses becomes clear.

Countermeasures and Decoys

Additionally, advances in countermeasure technology provide increasing challenges to successful intercepts. Countermeasures consist of: penetration aids that defeat sensors across multiple frequencies; normally occurring debris such as tanks, booster stages, and rocket parts; chaff; decoy balloons; and a variety of objects and infrared flares that are designed to simulate TBM reentry vehicles. Another effective countermeasure is to modify the reentry vehicle to appear as debris. The effectiveness of these countermeasures is increased as multiple interceptors are launched to ensure successful engagement. With a limited interceptor inventory, a JTMD shield over Taiwan could most likely be overwhelmed by large numbers of countermeasure-equipped TBMs (Gombert and Isaacson 1999, 6). Additionally, short-range ballistic missiles (SRBMs) and cruise missiles may be able to launch undetected and fly under upper-tier defenses. Despite excellent performance by Patriot missiles in Operation Iraqi Freedom, the system showed distinct limitations as its sensors responded poorly to electronic “clutter” such as ground radars, radar jamming aircraft, and other communications systems (Berman 2001-2004, Report 126).

As China clearly possesses the resources and technological capability to deploy sophisticated decoy mechanisms on its TBMs, appropriate JTMD systems must be applied to counter this threat. Without detailing specific system recommendations, the optimal active defense response to this threat is a system that can detect, track, target, and destroy threat missiles as close to boost-phase as possible. This type of system has the added benefit in that it is less likely to be threatening to the Chinese, as it would not be capable of engaging ICBMs launched from China’s interior (O’Hanlon 2001, 128).

However, this level of TBM threat will likely require consideration of JTMD attack operations to target missiles and launch facilities preemptively with LACMs, SOF, and strike aircraft with ATG capabilities.

Anti-ballistic Missile Treaty

As each of the meta-analysis studies were completed prior to June 2002, each addresses the ABM Treaty as an issue with respect to JTMD. In general, the studies tended to overestimate the degree and intensity of Russian opposition to the United States' withdrawal from the treaty. Ultimately, Russian opposition was manifested in little more than political rhetoric and strong verbal statements. Therefore, while conclusions with regard to the ABM Treaty are not directly relevant to this analysis, they do provide some insight. The relative ease by which the US withdrew from the ABM Treaty is representative of the realization that ballistic missiles are a very real and immediate threat. Few nations can argue that some form of missile defense is not justified or legitimate in order to protect citizens and interests from TBM coercion and terrorism. It is necessary to acknowledge that the studies concur that the ABM Treaty is no longer an appropriate construct for US-Russian security relations and that it does not account for significant changes in the contemporary operational environment (Gombert and Isaacson 1999, 16).

Systems Considered

Although each study in the meta-analysis considered various JTMD components and systems in conducting their analysis, the actual systems themselves are not necessarily pertinent to the larger issue of JTMD deployment. As stated in chapter 1, JTMD is an inherently joint mission that will most likely employ ground-, sea-, and air-

based systems, capable of endo- and exo-atmospheric engagements, to attain a synergistic and layered effect. This synergy is attained as each system's capability is leveraged to provide multiple engagement opportunities during boost, midcourse, and terminal flight to provide a near leak proof defense. The major systems considered in the meta-analysis studies are Patriot Advance Capability 3 (PAC 3), Terminal High Altitude Area Defense System (THAADs), Navy Theater Wide (NTW), and Airborne Laser (ABL). Each system is described in greater detail in Appendix B.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Important US Interest

As determined by the author's application of the Nuechterlein and USAWC frameworks, the US has "important to vital" interest in the Taiwan scenario. This ambiguous level of intensity lies on the theoretical line that determines when a nation must take military action, or may decide to apply other means of protecting the interest. At present, the US interest in Taiwan is significantly important to the point that a reevaluation of JTMD support and arms sales is required. This evaluation should focus on responding to the growing Chinese missile threat by providing Taiwan the ability to respond appropriately and discourage future aggression and TBM proliferation by China. This involves providing Taiwan with the capability to conduct active, passive, and attack JTMD operations. These recommendations do not supersede the US objective of supporting a peaceful resolution to the conflict; they support it. Limited increases in active and passive measures are no longer sufficient to maintain a "status quo" with China. In the event of a Chinese-initiated conflict with Taiwan, US interests are likely to shift to vital. This type of conflict would necessarily change the value to risk ratio in favor of taking military action. In this event, the US should refocus JTMD capabilities to protect Taiwan.

The Status Quo Is Not--Maintain Balance

In order to honor its long-term commitments, and remain within the letter and spirit of the *Taiwan Relations Act*, the US must provide JTMD support to Taiwan. The

majority of studies on this topic stress the importance of maintaining the status quo in order to provide China and Taiwan the opportunity to peacefully resolve reunification issues. However, the fundamental challenge with this approach is in determining the appropriate level of JTMD support to offset Chinese TBM proliferation opposite Taiwan. The consistent increases in Chinese TBM capabilities cannot be adequately explained by the security dilemma paradigm as they have little impact on China's survival security interests. In reality, this missile build up is simply an aggressive measure to increase China's ability to coerce Taiwanese leaders into a unification plan.

As the Chinese missile threat has steadily increased over the past decade, the perceived status quo has steadily changed as well. While the United States has limited Taiwan's active JTMD capabilities, China has moved forward with unlimited missile proliferation. Each increase in Chinese TBM capability against Taiwan must be met with an increase in Taiwanese JTMD capability in order to retain balance. Therefore, the security challenge facing the US is no longer how to maintain the status quo, but how to maintain a balance that allows the best chance for peaceful resolution. In order to achieve this security balance, the US must provide a combination of US JTMD assurances, offensive and defensive JTMD system sales, and system support in terms of doctrine, organization, training, C4I integration, and ISR capability to Taiwan.

Independent US and Taiwan JTMD Capabilities

The issue of US-Taiwan interoperability is fairly clear. The US should not seek to sell or design Taiwanese systems that are interoperable with those of the US. While some systems such as the PAC 2 missile system may be in use by both the US and Taiwan, both would have some level of inherent interoperability. However, the US should not

include Taiwan in the system architecture of JTMD in East Asia. The reasons for this are threefold. First, this level of interoperability would exceed the reasonable bounds of the *Taiwan Relations Act* and create a de facto security alliance similar to the US-Japan Security Alliance. This would undoubtedly threaten China and lead immediately to a crisis situation. Second, this level of interoperability is not necessary. As long as the US is prepared to act in the defense of Taiwan, China's chances for success in any type of offensive action are extremely limited. The US could defend Taiwan more effectively by fighting alongside Taiwanese forces as opposed to establishing an interoperable combined force. Third, the practical, technological, and fiscal impediments to binational interoperability are significant. Evaluating the North Atlantic Treaty Organization's (NATO's) challenges in integrating new member nation military capabilities easily evidences this.

US JTMD Capability

Independent US and Taiwan JTMD capabilities provide the best alternative for a stable security environment in the East Asian region. In terms of an adverse Chinese reaction, neither is likely to provoke China into an immediate conflict, but both are capable of responding to a potential conflict with a synergistic effect. The *2002 NSS* is clear in its intention to deploy JTMD to East Asia in order to protect US forces, friends, and interests.

From the perspective of the US, JTMD is an enabler that frees the nation from the threat of TBM coercion and facilitates the execution of alliance responsibilities. While this is largely predicated on the North Korean missile threat against South Korea and Japan, this capability provides the flexibility to reorient on protecting Taiwan from TBM

launches in southern China if required. JTMD facilitates this option without threatening the Chinese strategic nuclear capability. Independent of the Taiwan issue, this US JTMD initiative will continue development as a component tier of the US layered defense and NMD system.

Taiwan JTMD Capability

Passive JTMD

Taiwan undoubtedly requires a robust JTMD capability to protect its citizens from TBM attack, as well as from the terror of Chinese TMB coercion. As outlined above, the US should be prepared to extend JTMD coverage to Taiwan in the event of a conflict with China. However, without standing US JTMD support, Taiwan must be prepared to address initial missile strikes with a combination of active and passive defense measures. With respect to passive measures, the author concurs with the majority of conclusions in the meta-analysis. Taiwan must increase its ability to absorb TBMs that are not successfully engaged by active defenses. This includes, but is not limited to, hardening of command and control, interceptor, and aircraft facilities; increase in runway repair capabilities; and maximization of camouflage and concealment techniques. Few countries in the world face a TBM threat comparable to that of Taiwan and these measures are clearly prudent as a means of minimizing battle damage. However with an increasing Chinese TBM arsenal, these actions do little to maintain the balance described above or to achieve the elusive status quo.

Active JTMD

Active JTMD is clearly another capability that Taiwan requires in order to respond to Chinese threats. Having stated that active Taiwanese defenses should not be

interoperable with those of the US, the author partially concurs with the majority of findings in the meta-analysis. Taiwan should possess the highest quality JTMD system that it can afford and sustain. In this respect, arms sales from the US should be focused on those systems that provide a qualitative advantage against the high number of Chinese TBMs, but should not be further limited.

Due to the short flight distances involved and extensive numbers of SRBMs and cruise missiles deployed by China, the PAC 3 system is likely the optimal land-based choice. This is primarily due to the fact that exo-atmospheric JTMD systems, such as NTW, would be of little use against threat missiles that do not achieve altitudes high enough to provide an intercept opportunity. Additionally, in view of advancing boost phase technology, such as ABL, the menu of JTMD systems available for sales to Taiwan will increase in the future. The US should broaden the types of JTMD capabilities available to Taiwan, provided they are feasible, acceptable, and suitable to Taiwan, so that the island's leadership can take a greater role in its defense.

Attack Operations

Consistent with the increasing missile threat, Taiwan requires the ability to react to missile attack by offensively targeting and destroying launch facilities and missiles before they cause further damage to the island. This statement is predicated on the restriction that this capability be used only in response to a Chinese attack as a means of preventing further damage. Taiwan should not be allowed to use this type of capability in a preemptive capacity that would clearly initiate a confrontation in the Taiwan Strait. Therefore, it is in this area of attack JTMD capabilities that US arms sales to Taiwan should be considered, but measured and limited as well.

The primary rationale for these recommendations is the virtual consensus that a leak-proof JTMD shield over Taiwan is not feasible. The majority of meta-analysis studies agree that Chinese TBMs could easily overwhelm Taiwan's missile defenses, even with PAC 3. Furthermore, additional sales of lower-tier JTMD systems will not resolve this situation. Taiwan can no longer employ a qualitative JTMD solution that will be capable of defeating the vast number of missiles in the Chinese TBM arsenal. These facts lead to two logical conclusions. First, by virtue of clearly imperfect missile defenses, the Chinese already possess the ability to coerce Taiwan with TBMs. Second, and more importantly, the continued proliferation of Chinese TBMs opposite Taiwan steadily increases China's ability to apply this coercion despite upgrades in Taiwan's active and passive JTMD capabilities.

In this situation, the status quo cannot be maintained and a security balance can only be achieved by actively countering China's missile proliferation. Incremental improvements in Taiwan's attack operations JTMD capability achieve this effect. In this scenario, the limited Taiwanese employment of LACM, SOF, and ATG capabilities represent a measured and appropriate response to Chinese missile threats. Although these types of capabilities are clearly upsetting to China, they do not threaten Chinese sovereignty in terms of strategic deterrent capabilities, only in terms of the "One China" policy. In essence, this is the necessary response to China's decision to threaten Taiwan with ballistic missiles. As evidenced by US doctrine, attack operations are a critical component to achieving synergy from multiple JTMD systems.

Recommendations for Further Research

One of the significant impediments to conducting research on the US-Taiwan-China scenario is the lack of definitive US policy on the issue. The US has issued elements of policy vis-à-vis China and Taiwan in the form of the *Taiwan Relations Act*, the 2002 *NSS*, and the *QDR*, but a holistic strategy has yet to emerge. In the interim, the US has sponsored the entry of both countries into the WTO and continues to engage both on multiple social, economic, and political levels. The first recommendation for further research is to connect each of these US policy elements in terms of diplomacy, information dominance, military requirements, and economic factors to determine a recommendation for a comprehensive US strategy towards China and Taiwan.

A second recommendation for additional research is the evaluation of potential JTMD system architectures. As discussed with “layered defenses” and the “System of Systems,” multiple JTMD land, sea, and air-based systems are necessary to achieve the synergy of a leak-proof defense. However, the overall architecture detailing system sensing, tracking, cueing, engagement, and assessment responsibilities warrants additional research. This issue becomes particularly complex when attempting to integrate JTMD and NMD systems that are designed to address fundamentally different threats. This integration of capabilities to allow multiple engagement opportunities across the full spectrum of threat missile flight stages will be crucial to both deployed troops and homeland defense in the coming decade.

GLOSSARY

Airborne Laser (ABL). The ABL is a US Air Force-led effort to address the feasibility of an airborne laser system for defense against ballistic missiles. The project, conducted in cooperation with The Missile Defense Agency (MDA), Boeing, Northrop Grumman and Lockheed Martin has an objective of building an accurate, airborne, high-energy laser with the capability to shoot down ballistic missiles in boost phase. The ABL will operate at altitudes above the clouds where it can acquire and track missiles in boost flight, and then accurately point and fire the laser with sufficient energy to destroy the targeted missile. ABL will become the Boost Phase Intercept segment of the DoD's "Layered" Missile Defense System. (See figure 1)

Contemporary Operational Environment (COE). The contemporary operational environment (COE) is the overall operational environment that exists today and in the near future (out to the year 2020). The range of threats during this period extends from smaller, lower-technology opponents using more adaptive, asymmetric methods to larger, modernized forces able to engage deployed US forces in more conventional, symmetrical ways. In some possible conflicts (or in multiple, concurrent conflicts), a combination of these types of threats could be especially problematic.

East Asian Littoral. The East Asian littoral is defined as the region stretching from south of Japan through Australia and into the Bay of Bengal.

Joint Theater Missile Defense (JTMD). The strategies and tactics employed to defend a geographical area outside the continental US against attack from short-range, intermediate-range, or medium-range ballistic missiles – as well as passive measures, the C4I, and the Tactical Ballistic Missile Defense System forces that, in total, provide defense against ballistic missile attacks within an overseas theater of operations.

National Missile Defense (NMD). A system or "System of Systems" that counters strategic ballistic missiles or their elements in flight trajectory, consisting of interceptor missiles, launchers, and radars. The employment of these systems was limited by the ABM treaty of 1972 as they were viewed as "cutting in" to the strategic deterrence of the nuclear arsenals of other countries.

Republic of China (ROC). Taiwan is officially named the Republic of China. However, The US refers to the island as Taiwan and the World Trade Organization (WTO), which the island joined in 2002, refers to it as the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu. The Peoples Republic of China (PRC) maintains that the island belongs to the PRC.

Terminal High Altitude Air Defense System (THAADs). In February 2004 the Missile Defense Agency (MDA) renamed the Theater High Altitude Area Defense the Terminal High Altitude Area Defense system. The name change aligns the upper-tier interceptor with the nomenclature for the Ballistic Missile Defense System's three segments; Boost Defense Segment, Midcourse Defense Segment, and Terminal Defense Segment while signifying that THAADs will play a role in national missile defense as well as a theater missile defense.

Weapon of Mass Destruction (WMD). Any weapon or device that is intended, or has the capability, to cause death or serious bodily injury to a significant number of people through the release, dissemination, or impact of: toxic or poisonous chemicals or their precursors; a disease organism; or radiation or radioactivity – or any conventional weapon that causes death or seriously bodily injury to a significant number of people in a disproportionately short period and where the consequences of its release overwhelms local responders.

APPENDIX A

CHINESE BALLISTIC MISSILES

Overview of Chinese Missiles

This appendix provides the basic characteristics of selected Chinese ballistic missile systems likely to be encountered by US forces in varying levels of conflict in the Taiwan Strait. These missiles are either in use or readily available to Chinese forces. The selection of systems is not all-inclusive, but is representative of weapons and equipment supporting Chinese military capabilities against Taiwan.

Table 7. Overview of Chinese Missiles			
Surface-to-Air	Air-to-Air	Air-to-Surface	Surface-to-Surface
DK-9 / PL-9 HQ-1 / SA-2 HQ-2 / SA-2 HQ-3 HQ-7 / FM-80 HQ-9 / FT-2000 HQ-10 / SA-10 HQ-15 / SA-10 HQ-16 / SA-17 HQ-17 / SA-15 HQ-18 / SA-12 HQ-61 KS-1 LY-60 HN-5 / SA-7 HY-5 QW-1 QW-2	PL-1 / AA-1 PL-2 / AA-2 PL-3 / AA-2 PL-5 / AA-2 PL-7 PL-8 PL-9 PL-10 / FD-60 PL-11 / AMR-1 TY-90	YJ-1 / C-801 YJ-2 / C-802 YJ-6 / C-601 YJ-8 YJ-16 / C-101 YJ-22 YJ-62 / C-611 **	C-701 CY-1 FL-1 FL-2 / C-101 FL-4 FL-7 HY-1 HY-2 / C-201 HY-3 / C-301 HY-4 / C-201 SY-1 SY-2 HJ-8 HJ-73 AT-3 ** ** Missiles posing direct threat to Taiwan

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

Chinese Missile Nomenclatures

A frequent problem in correctly identifying the specific TBM threat to Taiwan is in definitively identifying the TBMs themselves. There are at least four sources of designation nomenclature for Chinese missiles:

1. Service Designation - the publicly disclosed name apparently used by the Chinese military once a missile enters operational service (e.g., YJ-8).
2. Builders Designation - the publicly disclosed name used by the enterprise developing the missile, before and after acceptance for operational service (e.g., C-801).
3. NATO Designation - the mnemonic names used historically by NATO in its application to Soviet missiles (e.g., SARDINE).
4. Defense Intelligence Agency (DIA) Designation - the alpha-numeric type designations, familiar from application to Soviet systems (e.g. SS = surface to surface), stylistically modified by the insertion of the modifying letter “C” (for China) at the appropriate point in the alphanumeric sequence (e.g. CSS-N-4).

Table 8 illustrates the relationship between the Chinese service designation, translation, and missile application for a sample of Chinese missiles

Table 8. Example of Chinese Missile Service Designation			
	Expansion	Translation	Mission
CY	Feilong	Flying Dragon	anti-ship - air-launched
FL	Hai Ying	Sea Eagle	anti-ship
HY	Shang You	Water Eagle	anti-ship - sea-launched
SY	Ying Ji	Eagle Strike	air-to-surface

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

Missile Designation Challenges

Further complicating the matter of accurately identifying Chinese missiles, several are used for multiple purposes, deploying the same missile in a variety of launch modes and roles. This hardware compatibility generates complications in correctly identifying the nomenclature of missiles since virtually identical missiles will acquire a new set of designators as they are applied to a new mission, launch mode, or role. For example, the ship-launched CSS-N-4 SARDINE becomes the CSS-C-8 SACCADE when launched from the shore. Complications also exist as the Chinese government has historically failed to disclose the existence of a variety of designations that are almost certainly in use by either the Chinese military or their counterparts in other countries.

Table 9. NATO and DIA Nomenclatures							
CHINESE				WESTERN			
Service			Builder	<i>Land-Launched</i>		<i>Sea/Air Launched</i>	
				DIA	NATO	DIA	NATO
HY-1	SY-1	FL-1		CSS-C-2	SILKWORM	CSS-N-1	SCRUBBRUSH
HY-2	SY-1		C-201	CSS-C-3	SEERSUCKER	CSS-N-2	
HY-3			C-301	CSS-C-6	SAWHORSE		
HY-4			C-201	CSS-C-7	SADSACK		
YJ-1			C-801			CSS-N-4	SARDINE
YJ-2			C-802	CSS-C-8	SACCADE		
YJ-6			C-601			CAS-1	KRAKEN
YJ-8			C-801/2	CSS-C-8	SACCADE	CSS-N-4	SARDINE
YJ-16	SY-2	FL-2	C-101	CSS-C-5	SAPLES	CSS-N-5	
YJ-62			C-611				
		FL-4					
		FL-7					

Source: Federation of American Scientists 2004, Rest-of-World Missile Systems.

Missile Ranges and Capabilities

The range, date of Initial Operational Capability (IOC), and the estimated inventory of Chinese ballistic missiles threatening Taiwan are illustrated in table 10. Discrepancies in translation from the Chinese service designation to the NATO and DIA designations are caused by differences in public record verses information disclosed by the Chinese government.

Table 10. Range, IOC, and Estimated Inventory of Chinese TBMs						
Chinese Designations		Western Designations		Range [km]	IOC	Inventory
		SS-1A	SCUNNER			0
	1060	SS-1B	SCUD			0
DF- 1	1059	SS-2	SIBLING			0
DF- 2		CSS-1		1,250	1966	0
DF- 3A		CSS-2	SILKWORM	3,000	1971	50-80
DF- 4		CSS-3	SEERSUCKER	4,750	1980	20-30
DF-11	M-11	CSS-7	SADSACK	300	1995	+40
DF-15	M-9	CSS-6	SAWHORSE	600	1995	+ 200
DF-21		CSS-5	SAPLES	1,800	1986	36-50
DF-25				1,700	cancelled	--
DF-61				1,000	cancelled	--
	M-7 / 8610	CSS-8		180		
	M-18			1,000		

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

Diagrams of Common Chinese TBMs



Figure 1. CSS 2 “SILKWORM”

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

First Test, 1966; Throw-weight, 2,000 kilograms; Yield, 1 @ 700-3000 kilotons or 3 @ 50-100 kilotons; conventional high explosive; Propellant Storable; Single Stage; Length, 24 meters; Diameter, 2.25 meters; Mass, 64,000 kilograms; Guidance, Inertial; Circular Error Probable (CEP), 1,000 - 4,000 meters; Launch Preparation Time, 120-150 minutes.



Figure 2. CSS 3 “SEERSUCKER”

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

First Test, 1970; Reentry Vehicle Weight, 2,000 kilograms; Yield, 2-3 megatons; Propellant, Storable Two Stage; Length, 28 meters; Diameter, 2.25 meters; Mass, 80,000 kilograms; Guidance, Inertial; CEP 1,400 - 3,500 meters; Launch Preparation Time, 60-120 minutes.

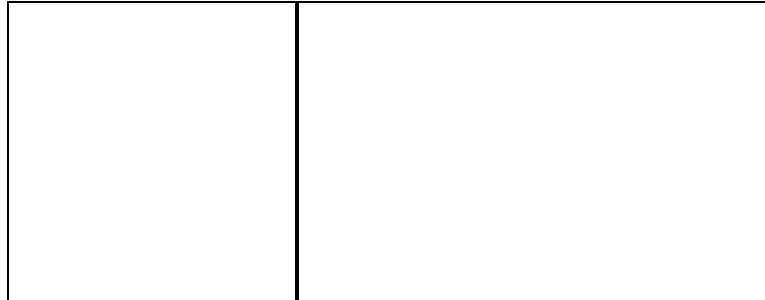


Figure 3. CSS 7 “SADSACK”

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

Contractor, Sanjiang Space Group; Operator, Second Artillery Corps; Single Stage; Length, 11.25 meters; Diameter, 0.88 meters; Mass, 6,350 kilograms; Propellant, Solid; Guidance, Inertial Deployment mobile; Reentry Vehicle Mass, 500 kilograms; Warhead Yield, 350 kilotons or conventional; CEP, 200 meters; Conventional Lethal Radius (soft target), 10 meter crater, 60 meter (unitary), 250 meter (submunition); Launch Preparation Time, 30-45 minutes.

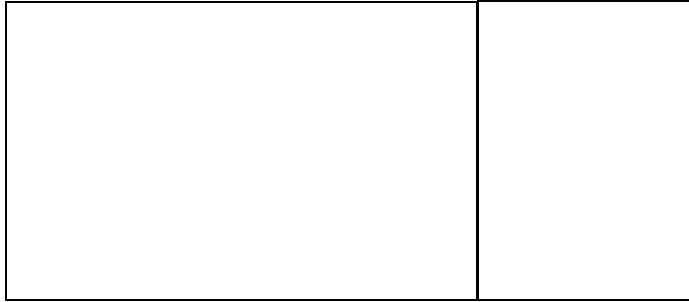


Figure 4. CSS 6 “SAWHORSE”

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

Contractor, Academy of Rocket Motors Technology (ARMT); Operator, Second Artillery Corps; Basing, Leping / Nanping / Yong'an; Single Stage; Length, 9.1 meter; Diameter, 1.0 meter; Mass, 6,200 kilograms; Propellant, Solid; Guidance, Inertial Deployment mobile; Reentry Vehicle Mass, 500 kilograms; Warhead Yield 50-350 kilotons or conventional; CEP 300-600 meters; Launch Preparation Time 30 minutes.

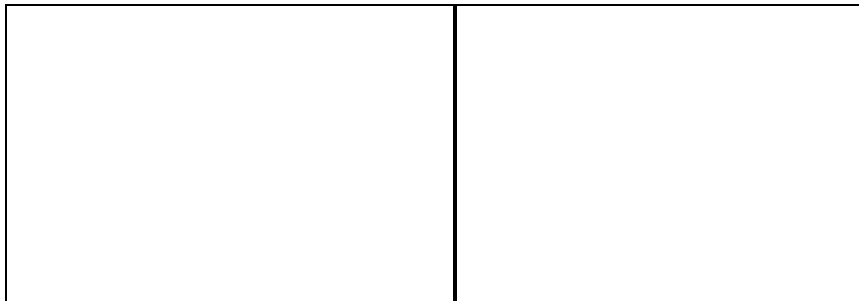


Figure 5. CSS 5 “SAPLES”

Source: Federation of American Scientists 2004, *Rest-of-World Missile Systems*.

Contractor, Academy of Rocket Motors Technology (ARMT); Operator, Second Artillery Corps; Basing, Chuxiong / Jianshui / Lianxiwang / Tonghua; Two Stage; Length, 10.7 meters; Diameter, 1.4 meters; Mass, 14,700 kilograms; Propellant, Solid;

Guidance, Inertial Deployment Mobile; Reentry Vehicle Mass, 600 kilograms; Warhead
Yield, 200-300 kilotons; CEP 300-400 meters; Launch Preparation Time, 10-15 minutes.

APPENDIX B

JTMD SYSTEM OF SYSTEMS

Overview

Conceptually, JTMD provides a protective umbrella against ballistic missiles through deployment of a series of sensors, radars, missile launchers, and C4I mechanisms in a limited theater of operations. Sea-based JTMD is a flexible system that can be erected quickly to protect deployed troops, economic and political assets, or sea borne carrier groups. The role of JTMD is to protect specific assets in a limited area from medium-to short-range, nuclear or conventional TBMs.

Layered JTMD

In order to adequately defend an island nation, such as Taiwan, JTMD would encompass a range of upper and lower tier systems. This is known as the “Family of Systems” or the “System of Systems” concept. Due to the complexity and diversity of missile and aircraft threats, a single weapon system is not capable of performing the entire JTMD mission. Upper tier systems, referred to as exo-atmospheric, are designed to engage and destroy medium-range ballistic missiles outside of the earth’s atmosphere during the missile’s midcourse phase at altitudes in excess of sixty miles. Lower tier systems, referred to as endo-atmospheric, are designed to engage and destroy medium- to short-range ballistic missiles within the earth’s atmosphere during the missile’s boost phase at altitudes within sixty miles. Both systems seek to defeat ballistic missiles at the maximum possible range to provide multiple opportunities for intercept and to decrease the likelihood that post intercept debris will harm protected assets. This is a vital consideration if the inbound missile carries a WMD warhead.

System of Systems

The US is currently in various stages of development of upper and lower tier JTMD systems. Figure 6 demonstrates the basic architecture of how a JTMD system may be configured. The systems illustrated were all considered by the think tanks in this thesis' meta-analysis. Each system is described in further within this appendix. Figure 6 demonstrates how each system complements the capabilities of the others to provide multiple engagement opportunities and a layered defense. All depend on space-based sensors for warning, launch location, projected impact, and estimated trajectory.

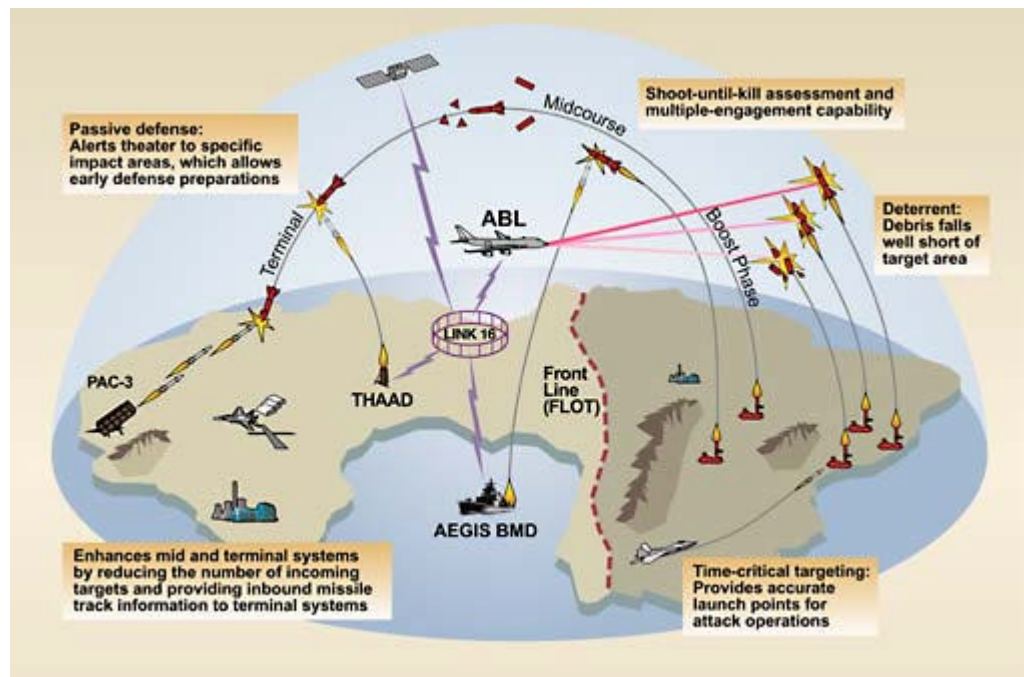


Figure 6. Boost, Midcourse, and Terminal Engagements

Source: Airborne Laser 2004.

Patriot Advanced Capability 3

Patriot Advanced Capability 3 (PAC 3) is a high-to-medium advanced surface-to-air-guided missile air defense system that engages TMBs endo-atmospherically in the terminal flight phase. Representing a major upgrade to the PAC 2/GEM system, the PAC 3 has a much greater coverage capability (30-45 kilometers) and far greater lethality (O'Hanlon 2001, 129). Additionally, the PAC 3 hit-to-kill kinetic warhead allows for a much smaller and more efficient missile. The PAC 3 interceptor has its own self contained radar for homing in on a target and features 180 small thrusters for fine steering in the final phases of intercept (O'Hanlon 2001, 129). Taiwan has currently fielded a number of PAC 2 weapons systems, but does not currently possess a PAC 3 capability. The PAC 3 canister is approximately the same size as a PAC 2 canister, but contains four missiles and tubes as opposed to a single round. PAC 2 launching stations can be modified to accept PAC-3 canisters with little difficulty, but upgrades to the radar and C4I are required as well.



Figure 7. PAC 3

Source: Federation of American Scientists 2004, *Ballistic Missile Defense*.

Terminal High Altitude Area Defense

The Terminal High Altitude Area Defense System (THAADs) provides the ability to engage TBMs at greater ranges than the PAC 3. This capability reduces the number of TBMs that must be engaged by lower-tier systems and also provide multiple engagement opportunities. THAADs's upper tier intercept capability increases the effectiveness of JTMD as the interceptor engages targets at a greater range in both endo- and exo-atmospheric altitudes, which minimizes post intercept debris over defended assets. The US expects to equip its first THAADs.

The THAADs radar can perform searches autonomously or it can utilize external cueing from other land-, air-, space- or sea-based sensors. The minimum equipment necessary to field a THAADs capability consists of a THAADs Radar, Battle Management C4I element, and some number of launchers with a basic load of missiles. The US plans to deploy THAADs units in conjunction with PAC 3 batteries to form an Air and Missile Defense Task Force. The THAADs System is air transportable and ground mobile.

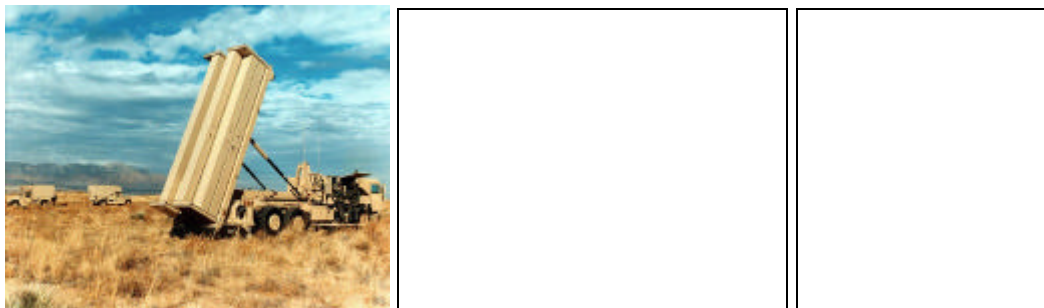


Figure 8. THAADs

Source: Federation of American Scientists 2004, *Ballistic Missile Defense*.

Aegis-Based Navy Theater Wide (NTW)

Aegis-based refers to the use of a Ticonderoga Class Guided Missile Cruiser (AEGIS)(CG) or Arleigh Burke Class Guided Missile Destroyer (AEGIS)(DDG) as the platform for the NTW system. The heart of the AEGIS systems is the AN/SPY-1, multifunctional phased-array radar capable of automatic detection and tracking of targets. This high-powered (4-megawatt) radar is able to perform search, track and missile guidance functions simultaneously with a capability of over 100 targets. The NTW interceptor provides an exo-atmospheric capability through a Standard Missile 2 (SM-2) Block IV fired from the vertical launch system. A critical shortfall of NTW in the Taiwan scenario is that, as an exo-atmospheric system, it would not be effective against SRBMs with ranges less than 500 miles because these missiles do not leave the earth's atmosphere and would not provide an engagement opportunity (O'Hanlon 2001, 132).

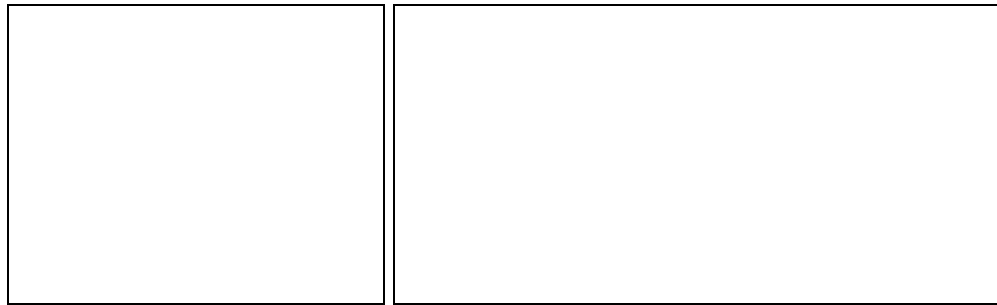


Figure 9. US Navy Arleigh Burke and Ticonderoga Class Ships

Source: Federation of American Scientists 2004, *Ballistic Missile Defense*.

Airborne Laser

The Airborne Laser (ABL) consists of a high-energy, chemical oxygen iodine laser (COIL) mounted in the nose cone of a modified Boeing 747-400F aircraft. The

system is designed to shoot down TBMs in their boost phase, destroying the missiles over the launch area. The system is designed to cruise at 40,000 feet with a four-man crew. ABM system can be programmed to operate autonomously to acquire and track missiles in boost phase, illuminating the target with a tracking laser while computers calculate its course and direction. After locking onto the target, a second laser, with weapons-class strength, fires a three- to five-second burst from the turret in the aircraft's nose. Pending resolution of issues dealing with the effective range of the laser and systems integration of the 747 aircraft, seven US ABLs are scheduled to fly operational missions by 2008.



Figure 10. Airborne Laser
Source: Airborne Laser 2004.

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